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THE MODEL ENGINEER

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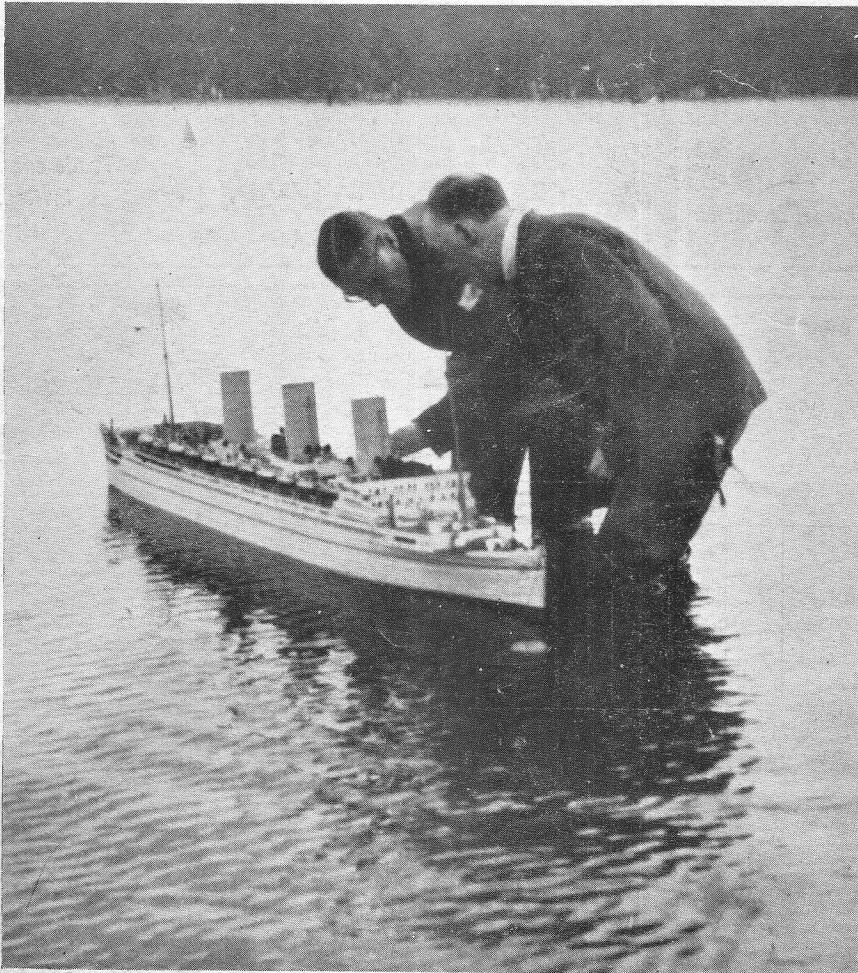


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[Edward Bowness]

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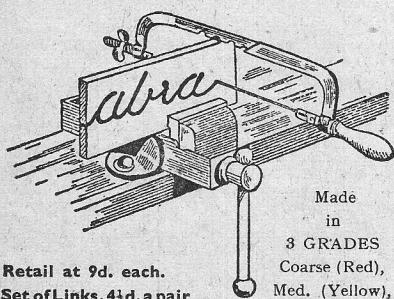
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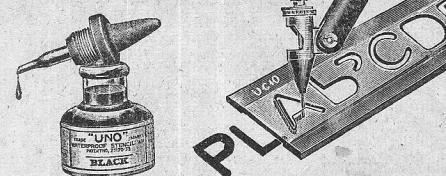
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THE MODEL ENGINEER

Vol. 94 No. 2335

Percival Marshall & Co., Limited
Cordwallis Works, Maidenhead

February 7th, 1946

Smoke Rings

Doctor Workshop

A SUBSCRIBER, who is a professional engineer, writes:—"I have been spending as much time as possible in my workshop lately, I find it helps to keep me sane. A workshop can be a wonderful restorative after the daily worries which unfortunately appear to increase as time goes on, and I don't know what I should do without mine, even though it's so small." Truly an excellent prescription.

Old Lathes Never Die

A N Australian reader sends me the following note about the rejuvenation of two old lathes during the munition crisis in that country. He writes:—"A recent short article in a Melbourne daily paper was headed 'Old lathes never die,' and gave some particulars of two old lathes which had been unearthed and reconditioned to help the munition industry during the tool shortage. Judges of antiques had dated their construction as somewhere around 1880, and the owners now don't want to part with them, as they are too valuable and too useful. One of them—by the way—was fished out of the river Yarra. It had possibly been souvenired by someone who was afraid to hang on to it when the 'census' of all available tools was being made." In spite of the revolution in machine tool-making which has taken place during the past half-century, there must still be a few old-timers doing good work here and there in this country, and it would be interesting to hear about them and their present state of health.

Lathe Prices in Australia

ONE of Australia's front line model engineers, Mr. E. E. Hadfield, whose very attractive beam engine model we illustrated some time ago, sends me an interesting letter about his recent activities. He makes a passing comment on the prices of imported lathes now prevailing in that country. He writes:—"I called at a shop in Melbourne recently to look at a 3½-in. Myford lathe which was being advertised. It was very interesting, being one of the first released since the war. Luckily for me, I am not wanting a lathe. The price asked was £97 10s., and there were six imported. Of this price, £20 was represented by sales tax. The following week the Government reduced the sales tax by 50 per cent., and the price of the lathe was reduced to £87 10s. Those who got in early to avoid the rush would feel like kicking themselves; the officials of the sales

tax department as well. The price before the war was, I believe, around £35. We have arrived at an era when we have to "make do with what we have got." Mr. Hadfield's remark about making do is borne out by his own patient efforts in building a side-lever marine engine, a type for which he has a great fancy. After some correspondence with various enthusiasts, he found the drawings by Mr. Hambleton of the engines of the Great Western, built by W. Dean. With this as a starting point, he made his own drawings for a model to a scale of $\frac{1}{8}$ in. to the foot. He says the pattern making has kept him busy to date, the side frames in particular, as both right and left-hand patterns are required. Setting out the parallel motion was another item which he says gave him much pleasure. I gather that all this work has been a labour of love in the true spirit of model engineering, and I am quite sure that when finished the model will be a worthy addition to Mr. Hadfield's collection.

A Message from Denmark

M R. A. LYNGKILDE, of Helsingør, in writing to promise some further news of model making activities in his country, concludes his letter thus:—"I beg you to receive my very best and hearty wishes for you and your work. I also beg you to receive for all British model builders my best wishes, as I have taken them for my model, and I hope they will and may proceed in the same fine style as hitherto." Great Britain responds and stretches out a hand to Denmark.

Romford's Promising Revival

THE Romford Model Engineering Club held an informal "house-warming" party at the Masonic Hall, Western Road, on January 26th. Some excellent examples of members' work were exhibited, and there was much renewal of old friendships in what promise to be far more spacious and convenient quarters than were available in pre-war days. Plans are in hand for the reconstruction of the Club's well-known track, but on much more ambitious lines than before; it is to be a multi-gauge track built at a lower level than the old one, but, it is hoped, still some 420 ft. in circumference. The future prosperity of the club seems to be assured.

Percival Marshall

long hours in office or factory.

It is hoped that the following brief description of locomotive, track and rolling-stock will be of interest to readers, and, perhaps, encourage others to try a garden railway which, I feel sure, they will find to be a continual source of interest and a delight to the children.

The Locomotive

A general outline drawing of the locomotive was first prepared, then separate drawings for boiler, chassis and valve-gear, before any attempt was made on construction. Work on track and locomotive then commenced in earnest, all the fine weather spare time being devoted to track, and the locomotive work reserved for wet week-ends.

The scale of the locomotive is correct for 5-in. gauge, as I think the 1-in. scale makes a locomotive look wrong, and it is practically no

trouble to use the correct scale.

Readers familiar with Messrs. Bagnall's industrial locomotives will readily recognise the origin of the design, and I am indebted to Messrs. Bagnall's for their kind assistance in supplying a very good photograph of their locomotive "Kenfig," which has been of great assistance in reproducing the characteristics of these fine little engines.

To describe in detail the building of *Ann of Holland* would take up too much valuable space in **THE MODEL ENGINEER**; in any case, the art of small locomotive building has been so well propounded by "L.B.S.C." that little can be added.

There are some features, however, which may be of special interest. The pistons are made from automobile piston metal, cast round steel centre bosses, which are bored out taper to take piston-rods. The valves also are die-cast

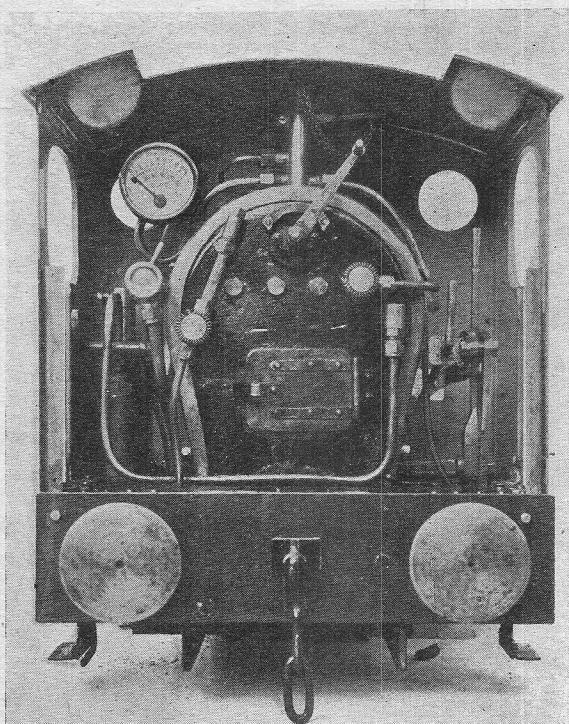
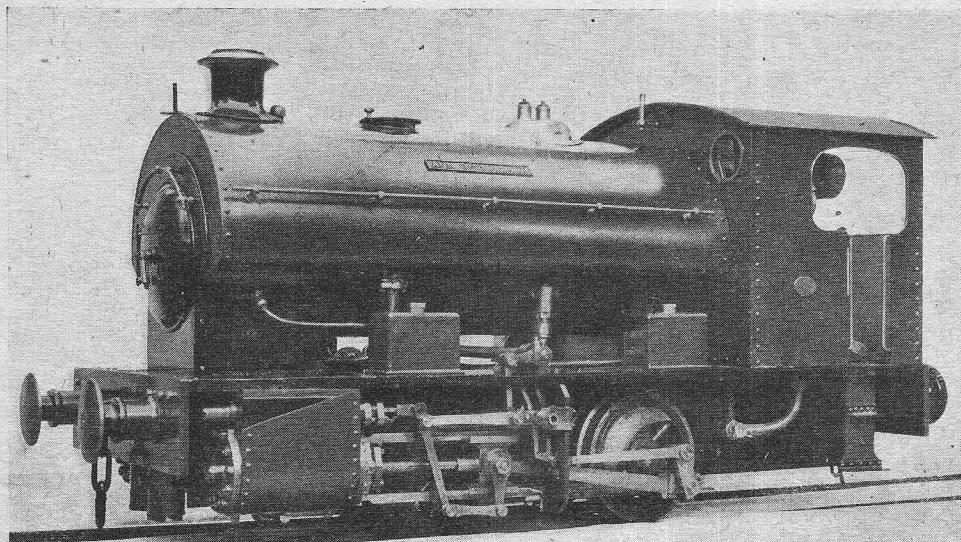


Photo by]

"Ann of Holland"—Cab view with back plate removed



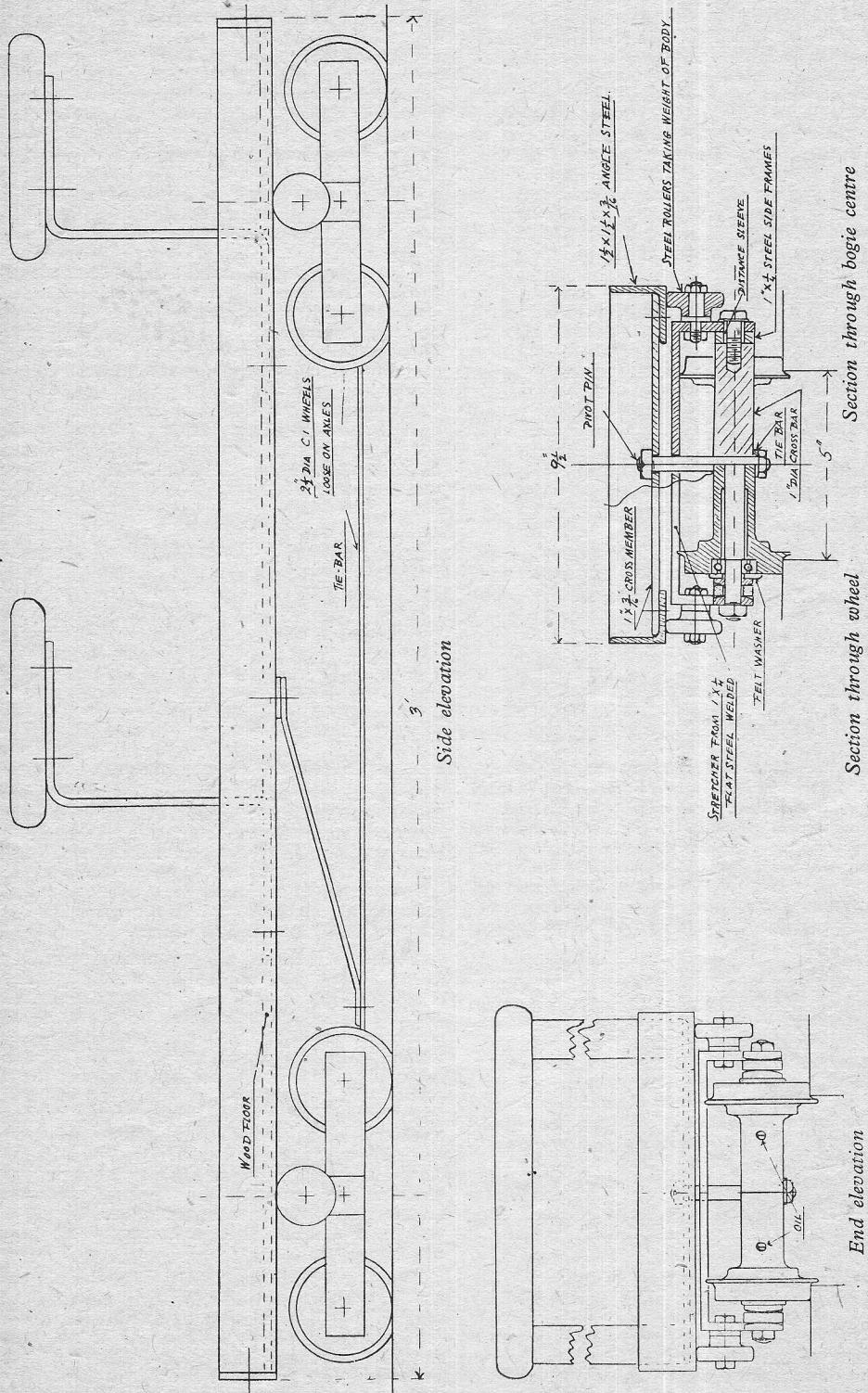


Fig. 3. Bogie passenger car for 5-in. gauge

Another "Real Live Steamer"

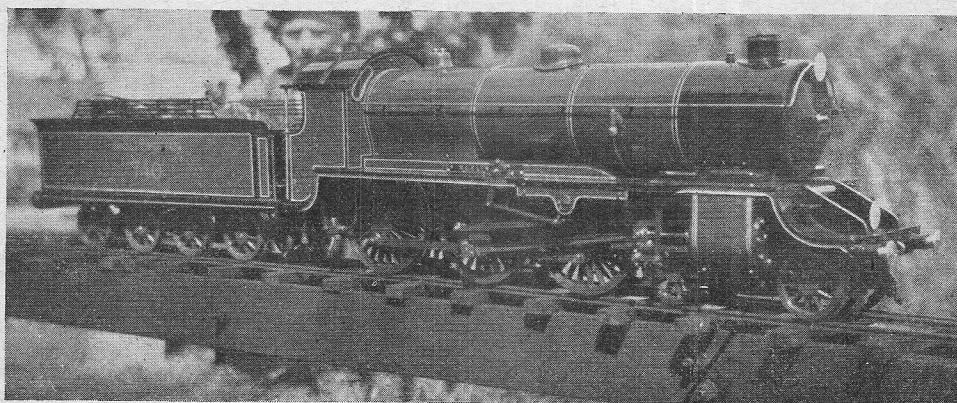
By "L.B.S.C."

HERE is a picture and a few details of a job which will upset the equanimity of the S.P.S.B.P.P., which being interpreted, means the Society for the Preservation of Small Bores and Pinhole Ports! She is a 3½-in. gauge edition of Bob Urie's "736" class on the old L.S.W.R., the forerunners of the famous Maunsell "King Arthurs"; and the builder, Mr. John Owen, has outbobbled even that merry old worthy himself. The cylinders on the big sisters were 22 in. by 28 in., the largest in the country—unfortunately, the boilers did not contain enough superheater elements to take full advantage of them, the area being about only half of what was really needed; but when Mr. Owen found that the cylinder castings supplied by Dick Simmonds would bore out to 1 7/16 in., he went "the whole hog" and added the equivalent of another inch in full-size! The results fully justified his optimism. Another factor in the decision was the fact that Mr. Rogerson's "Rainhill," which has been illustrated in these notes, has made many runs over Mr. Owen's line, and he says he has never ceased to wonder at the steaming capacity of its tiny boiler, so he thought "Merlin's" 4-in. kettle, with its proportionate firebox, wouldn't worry about the equivalent of a full-size pair of cylinders 23 in. by 28 in. It certainly doesn't.

The stroke is 1 7/8 in., the ports ½ in., and ¼ in. by 1 1/16 in. long, and the driving wheels 4 7/8 in. diameter, the whole of the engine and tender axles running in ball-bearing axleboxes. The boiler tapers from 4 in. at the smokebox end to 4 1/4 in. at the wrapper; the grate is 7 in. long and 2 1/4 in. wide; incidentally, about half that of my 2½-in. gauge "Mallet." A disc regulator is provided, and the rest of the boiler fittings are to "live steam specification," including an

injector and two eccentric-driven pumps. The valve-gear is not correct Urie pattern, but was enlarged from the drawings I gave some years ago for a 2½-in. gauge "Olympiade" (L.M.S. "5XP" class), and a few other departures from Southern practice were included, among them being the L.N.E.R. type of snifting-valve in place of the "snail's horns," and the smokebox saddle.

The locomotive is a complete success in every way; she has never been short of steam, and easily hauls 15 adults on three bogie cars around curves of 15-ft. radius; she will run like a deer with the lever in next notch to middle. She has a "pole" lever with four notches each side of centre. Mr. Owen is waiting an opportunity to try out the engine on the Birmingham Club's long continuous road and see what she really can do. Personally, I haven't the slightest doubt; and if any members of the fraternity mentioned at the beginning of this note are present, they will probably get the shock of their lives. As I mentioned once or twice before, I am on the "grapevine telegraph," and have heard that there are two or three "Lord Nelsons" being built with a bigger boiler than "Merlin," but only two cylinders of 1-in. bore, if you can imagine such a thing in these days of enlightenment! If the builders of these S.P., etc., locomotives are not above taking a tip, they should put four cylinders in, same as in full-size, of the bore mentioned, and see that the inside of the boiler conforms to the specifications set out in these notes from time to time. Well, congratulations to Mr. Owen on his fine job; I like the look of the stovepipe chimney and the inside-framed Drummond tender, and I'm sure friend Hambleton will clap his hands with delight at the destination boards!

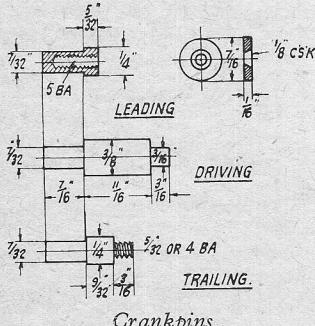


Mr. J. H. Owen's 3½-in. gauge "Urie"

road. The springs are wound up from 18-gauge tinned-steel wire—this engine is going to be on the "Bill Massive" side, and the springs must be fairly strong to carry her properly—and the spring-plates are merely $\frac{3}{8}$ -in. lengths of $\frac{1}{4}$ -in. by $\frac{3}{32}$ -in. steel strip, drilled as shown, and rounded at the ends; they are held by ordinary commercial nuts on the pins. After assembling, poke a $\frac{1}{2}$ -in. parallel reamer through each pair of boxes, and whilst turning it with a big tap-wrench, move the boxes up and down the slots. This will ensure that the axles will be free in any position of the boxes. Finally, set them right for the erection of the wheels and motion, by putting a little bit of $\frac{1}{8}$ -in. square rod between each box and hornstay, and tightening up the spring-pin nuts to hold it there. This will keep the axleboxes in the correct running position whilst all the erection, valve-setting, etc., is being carried out.

Coupled Wheels and Crankpins

The coupled wheels are 5 in. diameter on tread, equivalent to the 6 ft. 8 in. of the big engines, and are machined up exactly as described fully for "Petrolea." Briefly, chuck in three-jaw, by tread; centre, drill $27/64$ in., and ream $\frac{7}{16}$ in.,



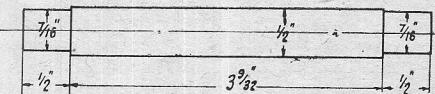
Crankpins

and face off back and flange. Reverse in chuck, face rims and bosses. Chuck an old wheel or disc slightly under 5 in. diameter, face it, recess the centre a little, drill and tap it to take a stub of $\frac{1}{2}$ -in. steel rod, screw in a piece about $\frac{3}{4}$ in. long, turn it so that the wheels slide on without shake, screw the end and fit a nut. Don't remove it from chuck, but mount each wheel on the stub, tighten with nut, and turn the tread and flange $1/64$ in. over-size with an ordinary roundnose tool. When the last one has been done, don't remove it from the stub, but regrind the tool and turn the tread to size. Then without shifting the cross-slide, take a similar finishing cut off the other five. You will then be certain that they are all exactly the same diameter, and no shovelfuls of noughts required! The flanges can be rounded-off with a file, whilst the lathe is running, and the slight chamfer on the edges of the cylindrical or parallel treads put on by the same means. Run the lathe at a slow speed to avoid chattermarks, and don't attempt to polish the treads for the sake of making the wheels look pretty; they'll polish themselves fast enough on the railheads when the "Lassie"

starts to run. The rails and wheel treads in full size are always bright and smooth.

The crankpin holes are drilled by jig, which is simply a piece of bar with a $\frac{1}{16}$ -in. peg in it to fit the holes in the bosses, and another $7/32$ -in. hole at a distance of $\frac{11}{16}$ in. away. Put the peg in the hole in the wheel boss, adjust jig so that the $7/32$ -in. hole comes in the middle of the "pear," and put the drill through the lot; see "Petrolea" instructions for illustration and fuller details.

The crankpins themselves are only a "kiddy's practice job," in a manner of speaking, and need no detailing out; just turn them from mild-steel rod to the sizes given in the drawings. Alternatively, if your three-jaw is like Caesar's

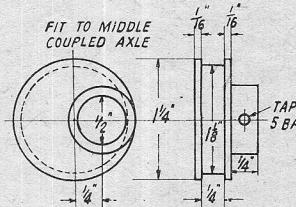


Straight axle

wife, or if your lathe has a collet chuck (once upon a time Swindon works had a very accurate Collett, but that is another story!) you can use $\frac{1}{4}$ -in. and $\frac{3}{8}$ -in. silver-steel for the pins, and leave the bearing surfaces unturned. A good bronze bush on a "natural" silver-steel pin, properly lubricated, forms a combination which works with imperceptible friction, and runs for an amazing length of time before showing any signs of wear. The leading crankpin has to be short, to clear the crosshead, and is drilled and tapped to take a screw for holding the retaining-washer, which is made from $\frac{7}{16}$ -in. round mild-steel rod. The spigots must be a tight press fit in the holes in the wheel bosses, and they will be, if you follow the method I gave for turning press fits in the note about "Jeanie Deans's" crank-axle. Use the vice as a press to squeeze in the pins, but don't split the bosses.

Straight Axles and Pump Eccentric

The two straight axles constitute another "L-card" job, the same strict caution being observed about the press-fit of the wheel seats in the wheel bosses. If the chuck is O.K., or



Pump eccentric

you can set the stock rod truly with a bit of paper or foil under an offending jaw, use $\frac{1}{2}$ -in. steel rod; if not, use the next available size larger, and turn the axles between centres. One wheel can be pressed on the end of each; leave the other until we have made the crank-axle. The eccentric for the feed-pump is

A Model Engineer Among the Watches

By C.S.C.E.

WATCH-WORK, ugh!" as "L.B.S.C." once remarked. But why "Ugh!" Presumably, because he does not like that kind of work, and not because he cannot do it. "Why watches, anyhow?" the gentle reader may enquire. Well, it's a change from model engineering, and much of it can be done sitting down, which is a big advantage as a hobby for those whose occupation entails standing all day.

Tools? Well, a lot of fun and experience can be had with a very limited equipment. Medium watch screw-driver—these have a flange loosely riveted to the top, and are operated by the thumb and second finger, pressure being applied by the first finger to the "loose-pulley" flange, two pairs of tweezers, one good quality with fine points and the other pair of brass, a fine file, pin vice plus small pliers and other gadgets from the existing model engineering paraphernalia, will do for a start. Incidentally, for more ambitious work, where a lathe or "turns" is indispensable, the average model-maker's lathe, though a bit on the clumsy side, will, with slight modifications, do all the needful. The two handbooks in THE MODEL ENGINEER series, on clocks and watches, Nos. 50 and 51 respectively, give ample information for making one's initial mistakes.

What about suitable first victims? Generally, one of the old Verge watch movements is recommended, but the writer is of the opinion that a cheap modern pocket watch such as an "Ingersoll Crown" stands a better chance of survival or resurrection, as the case may be. Then a Verge for No. 2 victim. A golden rule is to avoid, at all cost, commencing operations on a wrist-

watch (particularly one's own, and the girl friend's).

But be warned it time, gentle reader, that if once the collecting mania gets you, there is very little hope of a cure—the best that may be hoped for is to direct it into some particular channel, such as one of the following:—A definite historical period; enamelled watches, freak watches, such as musical and alarm, complicated watches such as chronograph, repeaters, clock-watches, perpetual calendars, etc. Or, for the highly mechanically inclined, an attempt may be made to collect watches all with different escapements. But the varieties of escapement, though very numerous as given in the more advanced books on the subject, become very rapidly more scarce and difficult to acquire, and the point is soon reached where only a very rich or very lucky collector can get any further, unless he is prepared to

convert ordinary watches to some of the freak or rare escapements. Some of these, though not easy to make, are quite within the capabilities of the more advanced model engineer with reasonable equipment, provided he has, or can acquire the necessary delicacy of touch, which is indispensable anyway in all watchwork.

The average model engineer, if the writer is any judge, will not, in any case, be interested in "mere" collecting, as is the case with the average collector, but will desire watches which vary from "requiring attention" to complete wrecks. This at once makes the hobby more interesting and, of course, very much cheaper.

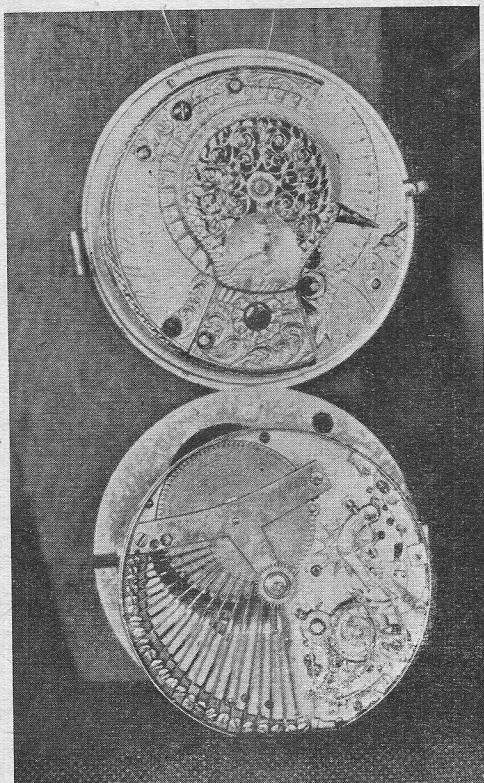


Fig. 1 (Above).—Verge by R. Williams, 1818. (Below).—Musical watch (combs and pin barrel to left; quarter repeating mechanism to right)

A Brief Historical Review of Escapements

From the earliest mechanical clocks still in existence, such as that at Rouen,

Next you take a needle of suitable size, let it down to a blue temper, hold it in a pin vice and rest it in a small "V" filed in a piece of boxwood held in the vice. Then, twirling the pin vice against the cut of the file with the left hand, file the needle slightly taper until it is of such a size that it just enters the drilled hole at its mouth, cut off about $\frac{1}{16}$ in. long and squeeze or

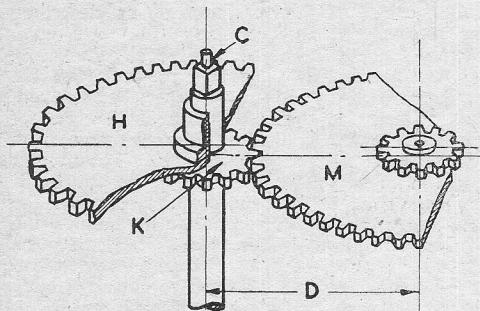


Fig. 3. Watch motion work. C, centre arbor; K, cannon pinion; H, hour wheel; M, minute wheel

tap gently into the hole until it bottoms. Then turn with hand graver or slide rest until it will commence to enter the pivot hole in the watch plate. Finally, first with an Arkansas slip, and then with a smooth flat (hardened) steel burnisher, with lathe running fast, reduce and polish the pivot so that it enters the hole up to its shoulder with little or no side shake, round up the end, and the job is done. It sounds rather formidable, but a little practice soon gives confidence. In the words of Sylvanus Thompson—"what one fool can do, another can." The main spring was replaced by one from another Verge. It should be the same width (height) and thickness (force), but provided it is not any higher than the original and not too much is expected of the final time-keeping qualities, we need not be too exacting. For instructions as to how to insert, and also how to mend fusee chain, see THE MODEL ENGINEER Handbook, page 19. The chain repair is straightforward, but very fiddling.

The broken verge was a nasty problem, as it was an unusually long one. There are very few men left in England today who can "turn in" a new verge—and probably fewer still who are willing to do so, from which it can be inferred that this is not a job recommended to the amateur on which to try his 'prentice hand. After much searching in the scrapbox, the writer eventually found an unbroken verge which was a little too long, and after some narrow escapes, succeeded in getting it correct. Had the watch not been a family relic, he would certainly have scrapped it, as watch movements of this type are still fairly common and inexpensive.

Fig. 1 (bottom) is the remains of a musical watch with "quarter repeater" work. The circular disc at 11 o'clock is the barrel containing the mainspring for the musical part, and has on its top surface innumerable minute pins, like those round the periphery of a musical box

barrel, but much smaller. As the barrel rotates slowly, these pins engage in the proper sequence with the bank of tuning-forks, as seen (there is another set underneath) and result in a very pleasant tune of considerable duration. This was "let-off" automatically at each hour, or at will by a lever. The conglomeration of parts to the right is some of the quarter repeating work. Actuated at will by the wearer, it repeats the previous hour, followed by a "ting-tang" for each quarter of an hour which has also elapsed—hence, the name.

Apart from being minus its case and face (dial) there is a formidable list of casualties, so it remains at present on the shelf, except for occasional tune-playing.

Fig. 2 (top) shows a timepiece which is really two watches in one, as can be seen. It is an early form of chronograph, employing two trains and two barrels, but only one escapement—a normal lever. The last arbor of the stop-watch train has on it a projection or "flirt," which is of such a length that it strikes the teeth of the

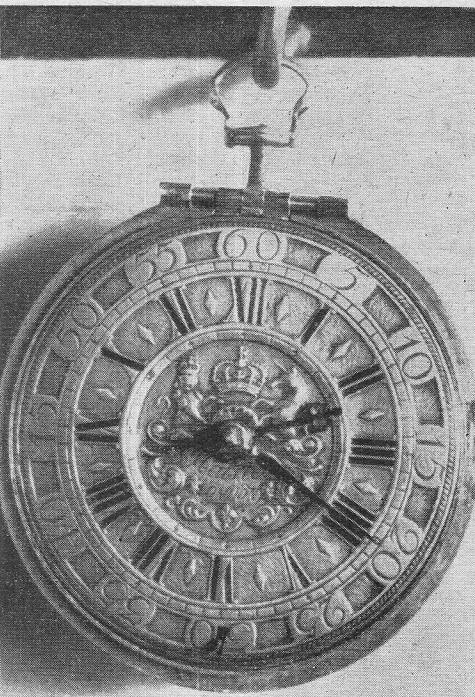


Fig. 4. Verge by John Halsted, London. c. 1690

escape pinion of the ordinary train. As the latter rotates, it releases this flirt, which then makes one revolution and is stopped by the succeeding tooth of the escape pinion. The gear ratio and number of teeth in the pinion are so arranged that the flirt, and consequently the stop-watch train, are released for one revolution each second. Thus, the long "centre-seconds" hand on the dial jumps whole complete seconds. The sound

Petrol Engine Topics

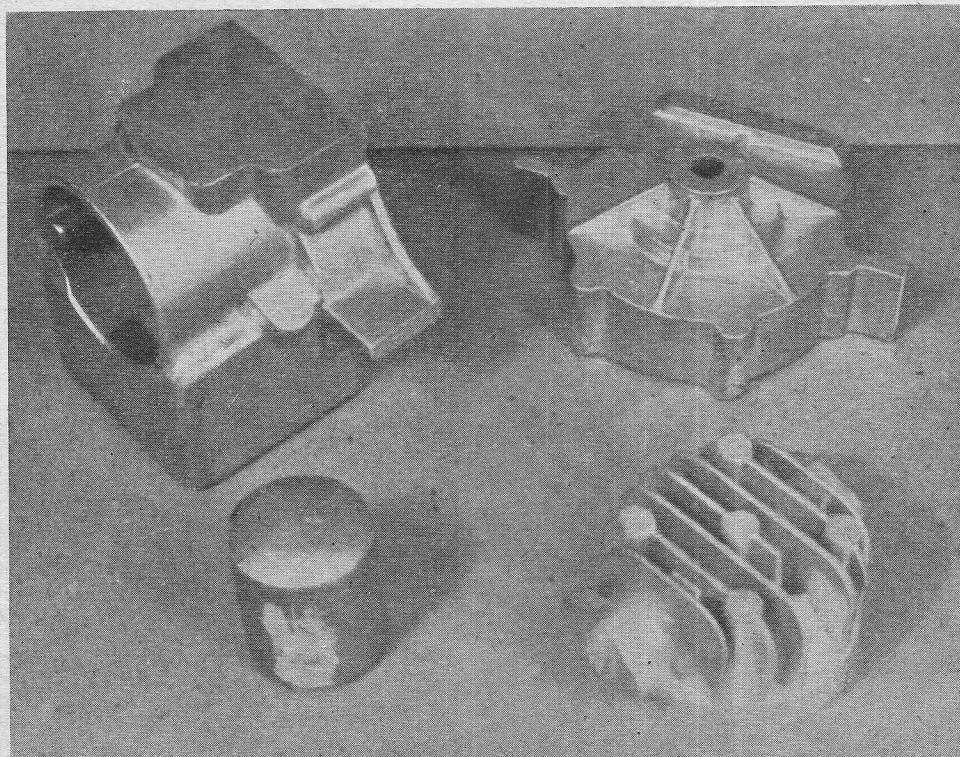
“Coming Attractions”

By E. T. WESTBURY

IF there are any of my readers who object to the amount of space I am devoting to trade news in “Petrol Engine Topics” nowadays, my only excuse is that I believe it to be very welcome and long-sought news to the majority of readers. For a long time now, a very large proportion of the queries which I have received have been concerned with the supply of raw materials, components and accessories for model petrol engine construction, and the impossibility of assisting querists in obtaining these things has been one of my biggest worries. Now that there are definite hopes that supplies will again be available, I feel sure that most readers will bear with me if I do my best to stem the flow of queries by announcing publicly any information which comes my way on this matter. Readers who prefer to have more space devoted to purely technical topics may rest assured that I have no intention of

turning these columns permanently into a trade catalogue; as soon as conditions become more normal, and the clamours of anxious querists disperse, we can settle down whole-heartedly to the discussion of problems in design and construction, without having to worry our heads where to get supplies.

Castings for model petrol engines have been obtainable in small quantities practically all through the war, though traders have often found it more expedient to keep the fact dark than to advertise it, and in many cases my enquiries, made either on behalf of readers or myself, have elicited only non-committal replies, or none at all! Even at the present time, some of the traders who formerly marketed castings for engines of my design, and which I know to be much in demand among readers, are still strangely silent on the matter, and apparently reluctant to let me know whether they intend



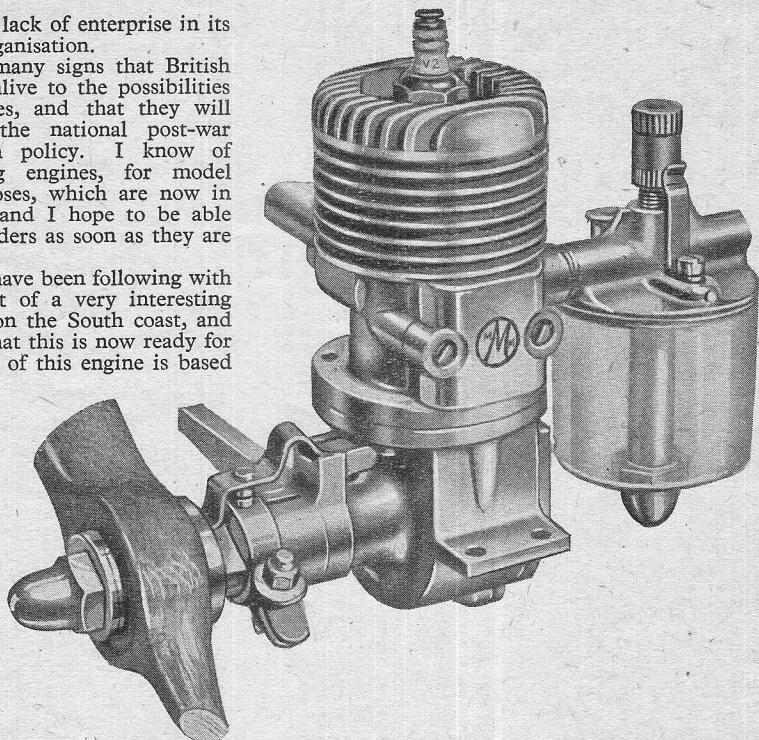
Sample die-castings for the crankcase, piston and cylinder-head of the “Kittiwake” 15-c.c. engine

engine can be ruined by lack of enterprise in its production and sales organisation.

There are, however, many signs that British manufacturers are now alive to the possibilities of model petrol engines, and that they will not be neglected in the national post-war industrial reconstruction policy. I know of several very interesting engines, for model aircraft and other purposes, which are now in course of development, and I hope to be able to introduce them to readers as soon as they are ready for the market.

For some time now I have been following with interest the development of a very interesting little engine, by a firm on the South coast, and am now able to report that this is now ready for production. The design of this engine is based

The "Majesco" 4.5-c.c. engine



on experience with the small-scale quantity production of a pre-war engine which attained some success in model aircraft propulsion. Since then, a considerable amount of experimental work has been done, not only on the engine design, but also in methods of production, and in finding the most suitable materials. The dies for castings have been produced in the works, and these also have involved a good deal of experiment. In this, and other matters connected with the development of the engine, my co-operation has been invited from time to time, and, I have reason to believe, has proved helpful.

The engine is known as the "MAJESCO/45," and has a bore of $\frac{3}{4}$ in. and a stroke of $\frac{5}{8}$ in., amounting to approximately 4.5 c.c., or 0.275 cu. in. Its main structure is in aluminium alloy, the crankcase and main-bearing housing being in one piece, and having a spigoted blank endplate attached at the rear by three screws. The cylinder is an aluminium casting, with integral (non-detachable) head and chrome-molybdenum alloy steel liner, and has a separate transfer port cover attached by two screws. The piston is of cast iron, no rings being fitted, and is lapped to a tolerance of 0.0001 in. A high-tensile steel overhung and balanced crankshaft is fitted, and the connecting-rod is of light alloy, fluted on one side. Both the contact-breaker and carburettor are of fairly orthodox design, but their details are sound and well constructed. A transparent fuel tank is used, with a snap-lid filler cap, and the carburettor jet adjustment has a large milled head and a spring friction lock.

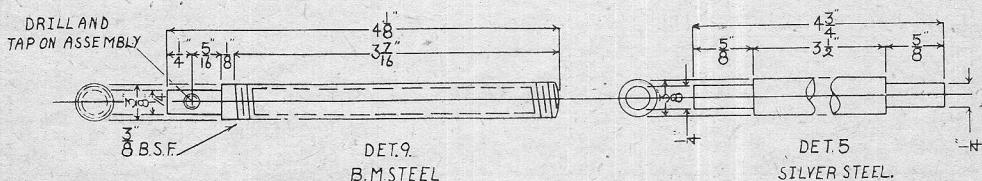
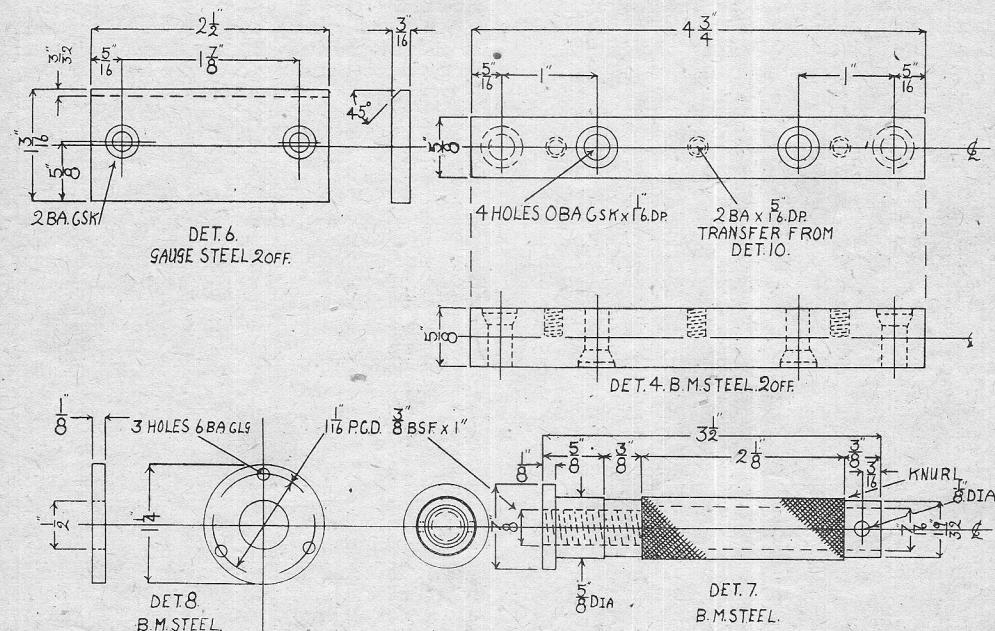
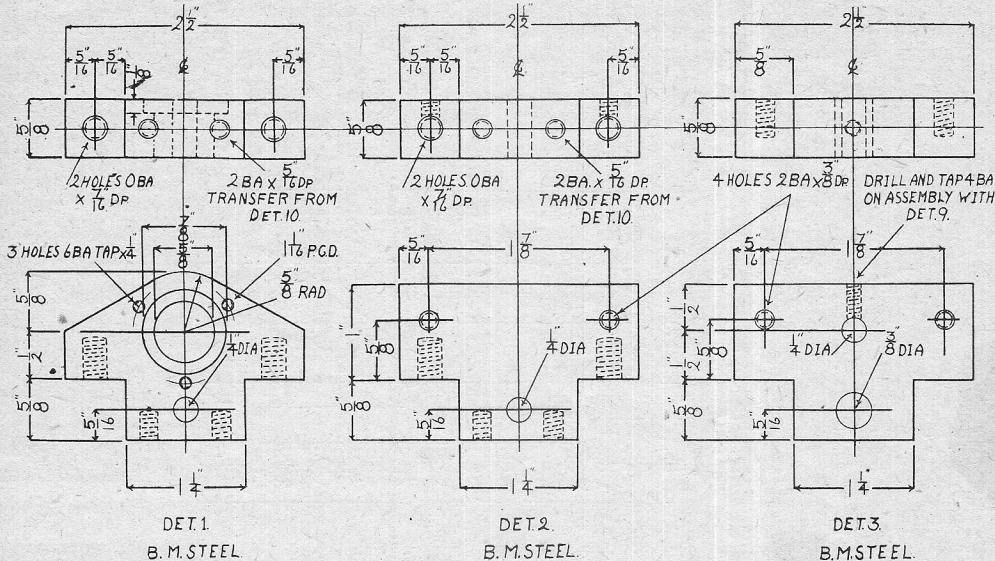
This engine develops quite a good power output for its size, and is reasonably free from temperament. It has been tested under load at speeds up to 7,500 r.p.m., and gives its best results with an airscrew 10 in. to 11 in. diameter. The bare weight of the engine is 6 oz., and it measures $3\frac{1}{4}$ in. in overall height. It can be run either upright or inverted, and the direction of rotation can be reversed with no other alteration than the re-timing of the ignition.

All accessories for the engine, including ignition coils, condensers, batteries, sparking plugs, and airscrews, will be separately available. Enquiries regarding this engine should be made to Majesco Miniature Motors, 35, St. Floras Road, Littlehampton, Sussex.

Castings for the Atom Minor 6-c.c. Engine

I have received from the Headingley Motor and Engineering Co. Ltd., 8, Otley Road, Leeds, a sample set of castings for the above engine, which they are putting on the market. The main castings are in aluminium, except for the cylinder, in cast iron, and the connecting-rod in bronze, raw stock material for the cylinder-head and other parts being included. Customers are given the option of the built-in tank at the back of the crankcase or a blank end-plate for use in conjunction with a separate fuel tank, also piston castings in iron or aluminium.

The Atom Minor 6-c.c. engine was described in the issue of THE MODEL ENGINEER, dated July 18th, 1940, and blueprints are available from THE MODEL ENGINEER Publishing Dept. or through the above-mentioned firm.



A Hull Exhibition

THE Hull and District Society of Model and Experimental Engineers held a successful exhibition in the Drill Hall, East Hull Barracks, from November 22nd to December 1st last. All branches of model engineering were well represented, over 200 exhibits being on show.

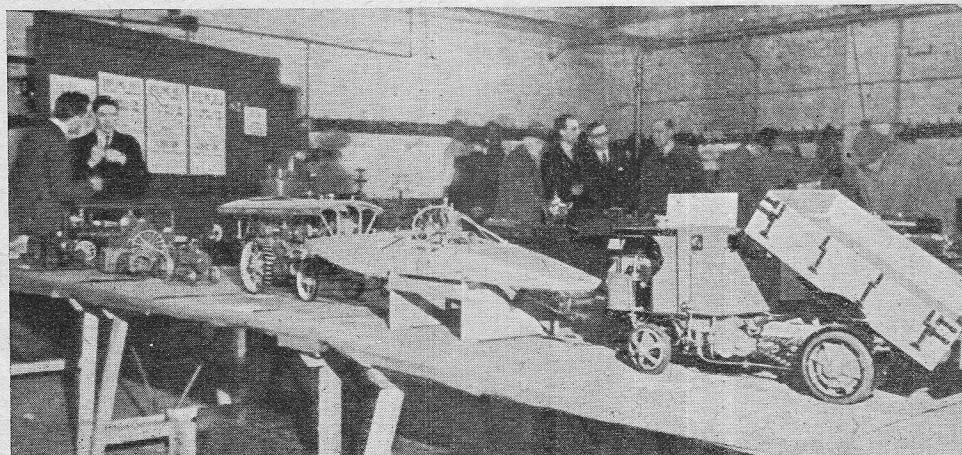
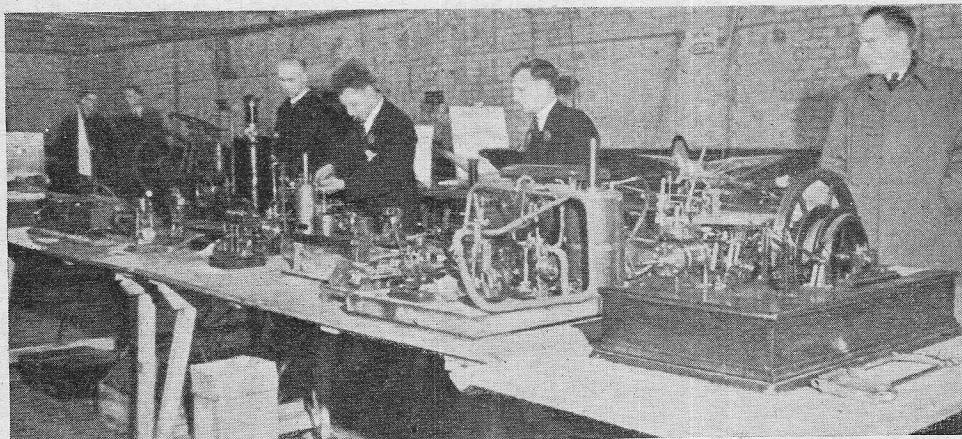
The passenger-carrying railway was, as is usual, one of the main centres of attraction, the service being run by Mr. Hobley's "Pacific." Mr. Fred Stone kindly loaned his "Princess Marina," and Mr. Hollings, of Bradford, came down to Hull on the closing day and ran his "Princess Elizabeth" on the track. The "fares" taken on the track benefited the Red Cross Society to the extent of more than £10.

Great interest was shown in the "compressor" stand, where some thirty models were running

under compressed air. This stand included beam engines, mill engines, a colliery winding engine, marine engines, pumps, horizontal, vertical and rotary steam stationary engines, and the winner of the R. W. Mumby Memorial Cup, Mr. C. G. Watson's 1½-in. scale traction engine, was also shown under compressed air.

Over in one corner, Mr. J. Wood demonstrated his "OO" gauge electric railway with its complete equipment of track sidings, goods yard, station and rolling-stock. Most of the small boys had a hard job to drag their fathers away from this exhibit.

Mr. Lawrence Sparey's compression-ignition engine aroused great interest, especially among the members of the Hull and District Model Aero Club, who believe that this is one of the things they have been waiting for.

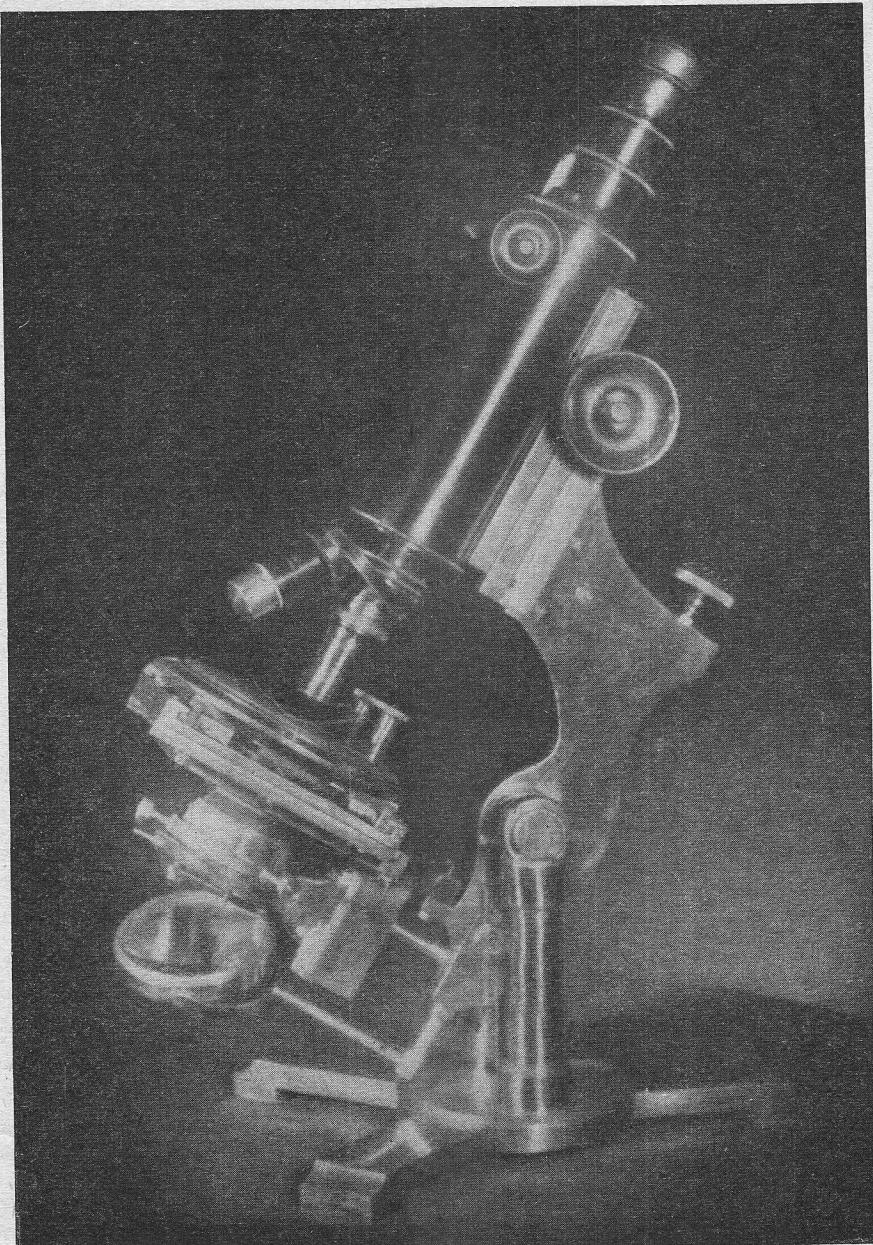


Above.—The compressor stand, showing some of the working models. Below.—General engineering section

carried out on the lathe, the job running at high speed, and then polished with very fine wire wool, a procedure which imparts a very high finish on brass. The other parts were finished with scratch brushes and mops. The lacquering

our readers, the lacquer is deep gold, obtainable from Messrs. Canning, of Birmingham.

As regards the performance of the instrument, the objectives at present in use are a Watson 1-in., a Beck $\frac{1}{8}$ -in., and a Watson 1/12-in. oil



proved quite tricky ; each piece was separately washed in alcohol, care taken not to touch them with the fingers. The lacquer was then applied with a soft brush, the finished result being quite satisfactory. For the sake of information to

immersion, not an ideal range, but all that was available at the time. The magnifying powers cover from 25 to 2,500 diameters. Many interesting things have been observed, in fact, the possibilities are inexhaustible.

Clubs

Croydon Society of Model Engineers

Meetings continue to be held on the first and third Thursdays of each month at the Café Royal, North End, Croydon, at 7.45 p.m. The next meeting, on February 7th, will be a lantern lecture on "Modern Developments in Miniature Petrol Engines," by Mr. Edgar T. Westbury. The following meeting, on February 21st, is to be a "Rummage Sale."

An exhibition is being arranged to take place in the autumn, details later.

Hon. Sec.: L. G. BOOMER, 11, Tritton Avenue, Beddington, Croydon. (Cro. 2150).

Burnley and District Society of Model Engineers

The next meeting will be held on Friday, February 8th, at 7.30 p.m., in The Rechabites Hall, Abbey Street, Accrington. A lecture will be given by a member. The membership is steadily going up; so new members, roll up and join the happy family!

Joint Hon. Secs.: J. D. MEE, 2, Windsor Avenue, Church, near Accrington; A. BATE, 36, Moseley Road, Burnley.

The Bristol Ship Model Club

A meeting took place on Tuesday, January 22nd. The exhibition was the main subject under discussion, and it was agreed that many valuable lessons had been learned, and would be borne in mind, when the next exhibition was planned. It is to be hoped that some sort of joint clubs committee will continue to meet, to hold these clubs together and work in amicable arrangement with each other.

A new lady member was welcomed, and a sample of her work in the shape of a "bottle ship" was passed around and admired.

The vice-chairman, Mr. McGuffie, was thanked for his work and attendance as permanent steward at the exhibition. It is understood a regatta is being arranged in the summer, as part of the activities of the club.

Next meeting, on February 12th, at 7.30 p.m., Seamen's Institute, Prince Street. Hon. Sec.: ARTHUR W. KIRTON, 29, New Fosseway Road, Knowle, Bristol 4.

Stephenson Locomotive Society

The annual general meeting was held on December 15th, at the Junior Institution of Engineers, Victoria Street, London, S.W.1, when nearly 100 members, including a good muster from provincial centres, were welcomed by the President, Mr. J. N. Maskelyne, A.I.Loco.E., who contrasted the Society's present strong position and rapidly growing membership with the low ebb in which it found itself in the previous victory year of 1918. The retiring chairman, Mr. J. H. Seaford (vice-president), presided with customary ability and received an ovation at the close of the meeting in recognition of many years' valuable work as general secretary, editor and chairman. Another veteran officer, Mr. W. H. Whitworth, for 25 years the indefatigable secretary for the North-Western

region, having for health reasons decided to resign, as from April next, was unanimously elected a vice-president, and accorded a vociferous vote of thanks.

Negotiations are proceeding in connection with the acquisition of permanent headquarters in London, when the library would be reopened. A full programme of meetings for lectures, discussions and so on is planned for 1946 in London, Manchester, Crewe, Glasgow, Edinburgh, Newcastle and Leeds. Other branch centres are in contemplation. By courtesy of the railway companies, or firms concerned, works and shed visits have been resumed. The Society's monthly illustrated journal continues to flourish. General Secretary: Mr. H. C. CASSERLEY, Ravensbourne, Berkhamsted, Herts.

Oldham Society of Model Engineers

Our next meeting will take place on February 8th, in Room 3, Co-operative Educational Building, King Street, at 7.30 p.m. prompt. Mr. G. Ogden will give a lecture on Domestic Moulding. The speaker for our last meeting was unable to appear. Impromptu lectures were given by Mr. K. Brooks on Milling Cutters, and Mr. R. C. Roberts also contributed some of his experiences in the Sudan. Both lectures were much appreciated.

Hon. Sec.: W. K. BUCKLEY, 87, Lyme Terrace, Highfield, Mossley, Lancs.

The Bolton and District Society of Model Engineers

The next meeting will be held in the Y.M.C.A., on Tuesday, February 12th, at 7.0 p.m., when the chairman of the Society, Mr. J. Denton, will give a talk on Power Production.

Hon. Sec.: A. H. BOOTHROYD, 113, Hilton Lane, Little Hulton, Nr. Bolton.

Exmouth and District Society of Model Engineers

The Exmouth and District Society of Model Engineers came into being recently, and a committee was formed and rules were drawn up. A room has been acquired at the Glenorchy Church Hall, Exeter Road, Exmouth.

The Society is intending to open on several evenings each week and the present membership of 25 is hoped to be increased when we become more well known.

The first meeting held on Tuesday, January 1st, included a display of several models, finished and unfinished, and although as yet we have no machinery installed in our room, there was a keen sense of enthusiasm among the present members.

Hon. Secretary: T. E. G. HOLMAN, "Belmont Cottage," Montpellier, Exmouth.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to Percival Marshall and Co. Ltd., Cordwallis Works, Maidenhead, Berks.

All correspondence relating to advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," Cordwallis Works, Maidenhead, Berks.

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For Sale, 30 c.c. Stuart Turner water-cooled, 2-stroke Petrol Engine, complete with coil and condenser, £8, or would exchange 3 c.c. to 10 c.c., in good condition.—Box No. 3887, MODEL ENGINEER Offices.

Mill Engine, 1" x 2", very good condition, £7.—MASON, 30, Beechfield Road, Bromley, Kent.

3½" Faircut Screwcutting Lathe for sale, few months old, nearest £35; set of Midge Wheels, 25s.; couple and connecting rods, fluted set of four, 12s.; axle boxes and other parts for 7½" Midge.—SCOTT, 32, Thornbridge Drive, Frecheville, Sheffield.

Hornby "Lord Nelson" (clock-work), rolling stock, rails, points, goods station, etc., £8; small Universal Motor, 200-220 v., $\frac{1}{2}$ h.p. A.C. Motor for re-winding, 15s.; 2 Car Dynamos, 6 v. and 12 v., 7s. 6d. each; armature (200-220 v.), gears and ball races for "Wolf" $\frac{3}{8}$ drill, 18s. lot; heavy 44" jaw chuck, 12s. 6d.; $\frac{1}{2}$ precision drill chuck, 10s.; small grinding head, 10s.; 7 B.A. steel screws, cheeched, $\frac{1}{8}$ " and $\frac{1}{4}$ " long (mixed), 1s. 6d. gross; flywheel and treadle for 3½" Drummond, round belt, £1;—WIDMER, 47, Boveney Road, Forest Hill, London, S.E.23.

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GENERAL

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"Modern Shop Practice" (6 vols.) American Technical Society, £5; "Locomotives," Bell (2 vols.), 35s.; "Locomotive Design," Phillipson, £1; "Modern Power Engineering," Regnault (4 vols.), £3; nearest offer accepted. All in new condition.—WHITEHORN, 3, Windsor Terrace, Stoke, Devonport.

"Model Engineers." Vols. 12, 26, 27, 40, bound; 3, 6, 7, 32, 34, 39, 42, 43, 44, 46, to 50, 52 to 64, unbound; 220 odd numbers in vols. 1 to 81; "Junior Mechanics," vols. 1 to 8 (incl.), and 10, bound; "Model Railways," vols. 1-9 (incl.). Offers.—WATSON, 49, Queens Avenue, Blackhall, Edinburgh.

Offers—80 MODEL ENGINEERS from 20-1-44 to 16-8-45 (3 missing), 22 "Practical Engineering," odd copies; 12 "Practical Mechanics," 6 Percival Marshall's "Boiler Making," etc. Clean condition. One lot. Letters only.—46, Nethway Avenue, Blackpool.

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For Sale, 138 "Model Engineers" October, 1942, to July, 1945; 1" scale 4-6-2 tanker, partly finished, boiler complete, less fittings, six driving wheels, 7" dia., mounted on axles, axle boxes and springs, chassis frames, cut out, need filing up, bogie frame assembled, four bogie wheels, machined, mounted on axles, cylinders, $\frac{2}{3}$ " x $\frac{1}{2}$ " bored, fitted pistons, rods, and glands. Smoke box door needs hinges. Some other small parts, and very useful box of odds and ends, and material, etc. What offers, reasonable.—63, Golden Hill Lane, Leyland, Near Preston.

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To those who were unable to secure a copy
of the January issue of

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AIRCRAFT**

(The official journal of the S.M.A.E.)

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being limited by paper rationing, proved
completely insufficient to meet it.

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A 5-in. Gauge Garden Railway

By J. H. E. RODGERS

A CHANGE of residence, in 1942, entailed the loss of my 2½-in. gauge garden railway, but never having been without a railway of some sort since my earliest teens, plans were soon on foot, after getting settled in, for a new layout.

Compared with my previous efforts, the requirements were very much more ambitious. It was decided that the new line must be continuous, and at ground level. On no account must it spoil the garden, but rather be part of the garden, blending in with the various rockeries and flower beds. Very important too, it must be capable of withstanding the ravages of climate, children and dogs, and finally, be large enough to carry a train of live passengers with some degree of comfort and safety.

All this was a tall order for a suburban garden, and not a large one at that, and it soon became apparent that 5-in. gauge was the only one likely to offer any chance of success, employing a 0-4-0 tank engine, and bogie passenger cars.

The necessity for employing this type of engine caused me no sorrow, as the humble 0-4-0 industrial type has always been a favourite of mine, and there are many handsome and interesting examples to be seen at work all over

the country. Such a locomotive seemed also to be far more in keeping with the track than a main line express type, which, in any case, would have to be jointed in the middle to get round the curves imposed by the limits of the garden.

Having now used both the elevated and ground-level kinds of track, I am bound to admit that my preference is for the ground-level for 5-in. gauge; but for the smaller gauges, where live passengers are carried, the elevated becomes a necessity.

There is a fascination in scooting along embankments, over bridges, and into cuttings, which is lacking in the elevated track, and to drive at night with head-lamp on the locomotive, and a small lamp in the cab to illuminate the gauges, is an interesting experience on a ground-level track. The speed seems much greater in the dark, and the track ahead shining in the light of the head-lamp, seems to run through a strange and interesting country, quite different from the familiar garden of the daylight hours.

This type of track needs some attention to keep it clear of leaves, twigs, weeds, occasional land-slides, and dog-bones; but it is all healthy outdoor work, very good for one spending

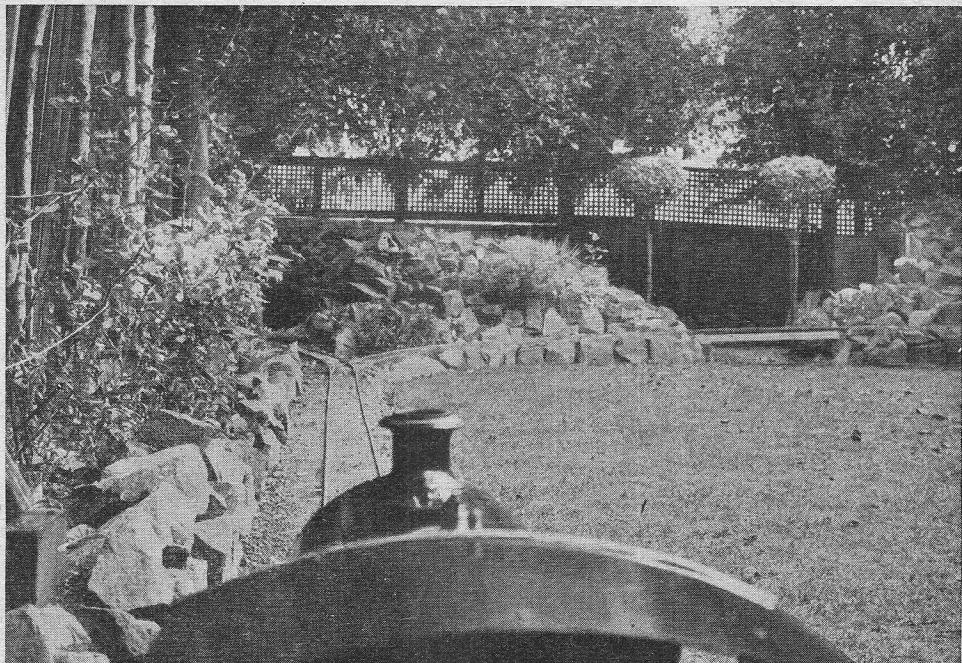


Photo by

Running down to Goblins' Gulch

[J. H. E. Rodgers

in the same metal, the exhaust cavity being cored out in the simple 'die' used. I find this metal wears very well with the hard-wearing gunmetal used for the cylinders. The cylinder drain valves and operating gear are shown in Fig. 1, and I have used this type on all my engines, having found nothing simpler or better.

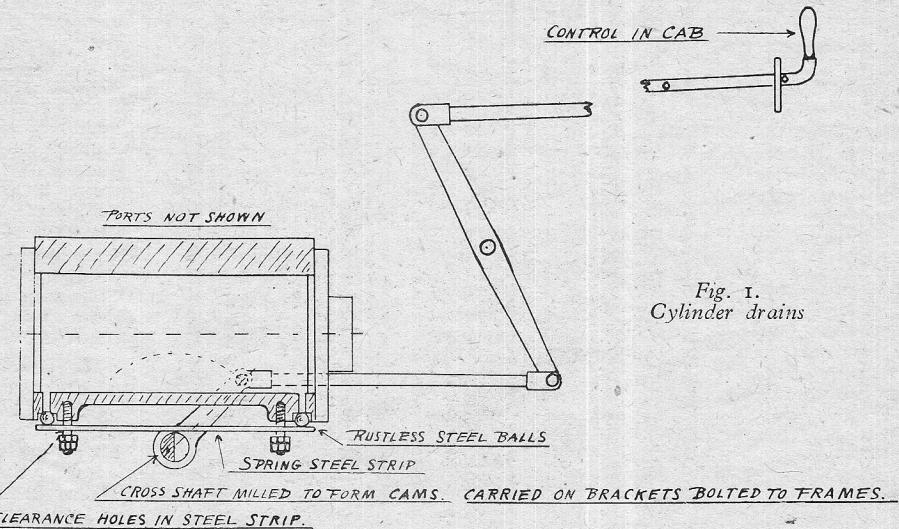


Fig. 1.
Cylinder drains

The mechanical feed-pump and filter are located just behind the front buffer beam, in which position it is possible to dismantle both filter and valves without lifting the locomotive from the track...

A rather unusual fitting is the automatic blower, which consists of a pressure-operated diaphragm valve in series with the usual blower-valve on backhead. This valve is set to open when boiler pressure falls 20 lb. below blowing-off pressure, and enables the driver to leave the

whilst the diaphragm valve is taking charge, causing the safety valves to lift when the fresh coal lights up; after this, pressure will remain practically constant, with just a breath coming from the blower. There is a large margin of safety between the water content of the boiler and the firebox capacity, and it is very satisfying

to come back to the locomotive after a cup of tea, to find her with a full head of steam, and the fire in good condition.

I am bound to confess, however, that I leave the locomotive in full view of the dining-room window, so that anything abnormal happening can be seen. No doubt, if nothing goes wrong we shall gradually gain confidence in the arrangement. When the locomotive is at work the ordinary blower is used, although the auto-blower can be left in action, if desired.

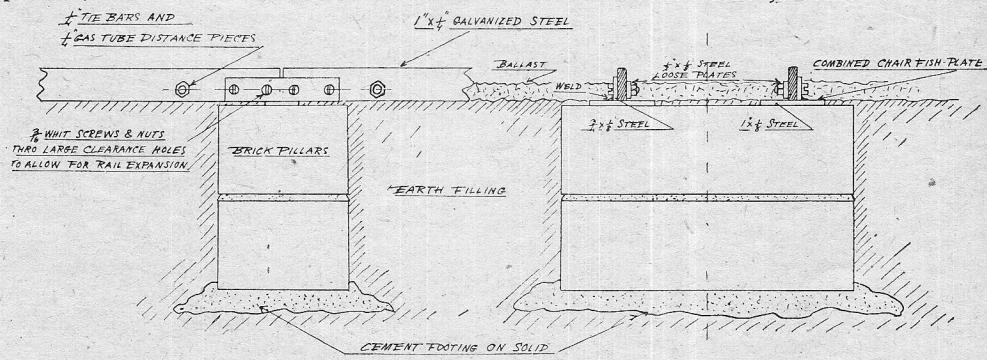


Fig. 2. Track and pillars

engine in steam for periods up to 45 mins. without attention.

To obtain this happy state of affairs, it is necessary to arrange for the water to be well up the glass, and the fire clean and bright, before the box is filled up with coal to the level of the bottom tubes.

In practice, there is a short period of hunting

The Track

This consists of 1-in. x $\frac{1}{4}$ -in. heavily galvanised steel, tied at 12-in. intervals, by $\frac{1}{4}$ -in. bolts and tube distant-pieces, and resting on brick pillars, spaced 18 in. apart.

Each pillar stands on a cement footing, the earth being excavated until a solid foundation is reached. The tops of the pillars are levelled-up

when building, with the exception of those on which the rail-joints lie, these being $\frac{1}{8}$ in. lower to allow for the thickness of the combined chair and fish-plate ; see Fig. 2.

The section of rail used is stiff enough to take the weight of the train between the pillars without depending on the ballast for any support. Earth and ballast are built up to a point half-way up the rail, to prevent side-movement of the track and also for appearance. It will be realised that the 1 in. deep rail presents a considerable area to side thrust on the ballast ; and this is important, as the rail is not anchored in any way to the pillars.

The rail lengths are so arranged that the joints always come in the centre of a pillar ; and, as will be seen in Fig. 2, the joint is completely supported by the combined fish-plate and chair resting direct on the pillar.

It might be thought that as the track is not fastened to the pillars constant traffic would cause the rail to move off the pillars. After many hours of running, there is no sign of this happening at any part of the track, the only movement observable being due to expansion

set over the week, and tarring rail, finally earthing up and ballasting the previous week's rail.

In front of the pillar laying, another operation proceeded round the garden, namely—transplanting innumerable garden plants.

All progress was held up at one time to allow some of these plants to finish flowering, it seemed as if they had never had so many or such gorgeous flowers before.

Finally, the circuit was complete, with a branch line running into the old air-raid shelter, this branch and the open door of shelter being clearly visible in the driver's-view photograph.

The shelter makes quite a good locomotive-shed, as the floor is several feet below ground level, and puts the locomotive at a convenient height for servicing. As a turn-table is also fitted in the shelter the locomotive can be swung round to get at both sides, both ends and underneath.

An entrance for the track had to be made through the wall of the shelter ; and only those who have succeeded in cutting through reinforced concrete with a hammer and chisel will know what this means.

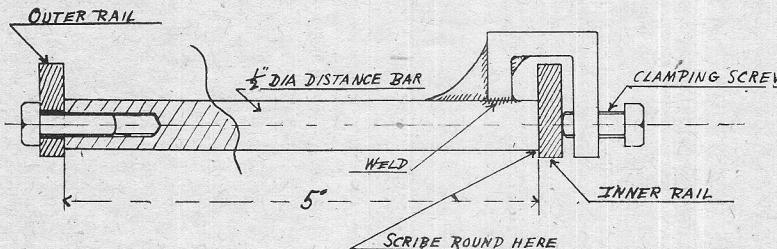


Fig. 4. Hole locating
jig for inner rail
on curves

and contraction in the hot sun on the curved portions, the maximum displacement being $\frac{1}{8}$ in. ; and this could, no doubt, be eliminated by using a distance-piece on the fish-plate bolts, to prevent fish-plates nipping the rail. The problem of finding where to drill the holes for tie-bars on curves was dealt with recently in THE MODEL ENGINEER ; but the mathematical calculations did not appeal to me, so I proceeded as follows :—

Several lengths of outer rail were cut, drilled, and set by means of a " Jim Crow " to the correct radius, and laid on the pillars, connecting them by means of the fish-plates. The inner rails were then cut and set to mate up with each length of outer rail, and the length of track assembled, using the special spacer jigs shown in Fig. 4. The tapped ends of spacer jigs were fastened by the set-screws through the holes in outer rail, then the inner rail was pulled up to distance-bar by the clamping screw.

When the track had been lined-up correctly, a line was scribed round each spacer jig on the inner rail, the inner rail dismantled and drilled for the tie-bolts in the centre of the scribed circles.

This length of track was then finally assembled with tie-bolts and distance tubes, and the whole painted over with hot tar.

So the track proceeded, a week-end work consisting of planting a line of pillars, laying rail on the previous week's pillars, which had

Passenger Cars

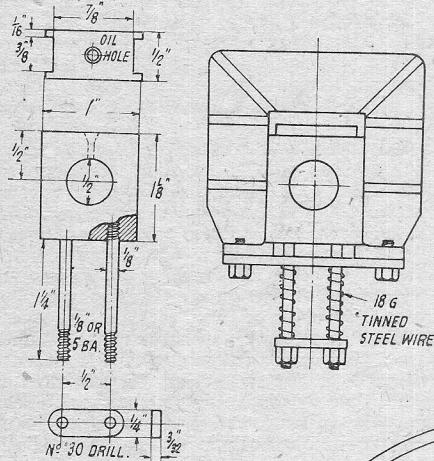
A good deal of attention and thought was paid to the design of these cars, as I wished to eliminate some of the faults I had previously experienced. Too often, it has seemed that the bogie car is a slapped-up make-shift at the last moment, to see how the locomotive pulls, little thought being given to lessening the friction in this grossly overloaded vehicle.

To lessen the tendency to turning over, due to the narrow gauge and high centre of gravity of the load, all form of springing was dispensed with, and the design arranged to transmit the weight on the body direct through rollers on to the full width of gauge ; see Fig. 3. The friction caused by wheels solid on axles traversing sharp curves with a heavy load, is very great, and this was overcome by providing independent wheels on fixed axles, a ball-race taking the load vertically over the wheel-tread. The boss at the back of the wheel is extended right up to the centre of axle, making a plain bearing $\frac{1}{8}$ in. wide on the axle. The load at the centre of axle is very light and has little reference to the load carried on the car.

The car is constructed almost entirely of flat and angle steel, electrically welded, light wooden floor boards being provided. There is a certain amount of spring in the seat brackets, and the seats are arranged so that the rear passengers' feet are under the seat in front.

“Hielan’ Lassie”

The six main axleboxes are of the solid double-flanged pattern ; there is no need to bother about using the full-size type of axlebox, with separate keeps and swivelling spring-pins, for anything below $\frac{1}{2}$ full-size, unless for "show" purposes. They are made from $\frac{1}{2}$ -in. by 1-in. cast or drawn bronze, or gunmetal bar ; probably the good folk supplying castings will be able to



Axlebox details and assembly

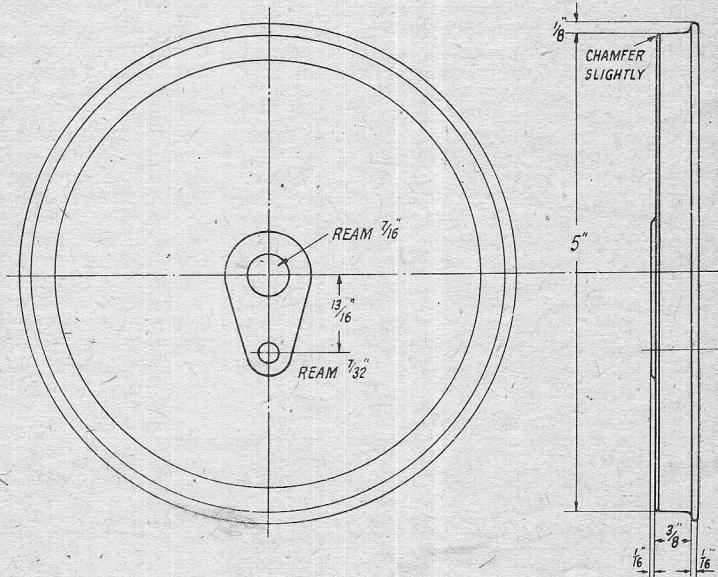
produce a stick of the right length and section for all six. This is machined up exactly as described for "Petrolea"; if a regular milling or planing machine is not available, clamp it under the slide-rest toolholder on your lathe, and traverse across a $\frac{3}{8}$ -in. end-mill or slot drill held in the three-jaw. If the traverse of the cross-slide is not enough to do the full length at one go, saw the piece of bar in half, and take two bites at it. The sides and flanges can be cleaned up with a file.

The boxes should be parted off the bar in the lathe, holding the bar in the four-jaw; or, alternatively, they may be sawn off, chucked separately, and faced off each end to dead length; the ends should be true and square with the sides.

Each box has a $\frac{1}{2}$ -in. hole at $\frac{1}{2}$ in. from the top. To ensure that the axles shall be dead square across the frames, mark the hornblocks 1 to 6, and fit the boxes to them, marking the boxes

also, so that they can be replaced in correct order whenever they are removed. Take out boxes 1, 2, and 3, on one side of the frames ; carefully mark position of axleholes, centre-pop, and drill first a $\frac{1}{8}$ -in. pilot hole, then open out to $31/64$ in. If a drilling-machine is not available, use the lathe, with a drill in the three-jaw and a drilling pad on the tailstock barrel ; the holes must go through square with the sides. The boxes on the opposite side should be drilled with the first three used as guides or jigs. Clamp No. 1 and No. 4 boxes together, either using a toolmaker's cramp, or in a machine-vice, the drilled one naturally being on top ; then the hole in the latter will guide the drill truly through the lower one. Serve No. 2 and No 5, then 3 and 6, with a dose of the same medicine. Don't ream them to size yet ; this is done last thing of all, with the boxes in place.

Put each box in its hornblock, and put the hornstays on; then wedge each box against the hornstay with a little wooden wedge or anything else handy, and run the No. 30 drill through the inner holes in the hornstay, making countersinks on the bottom of the axleboxes. Remove, drill the countersinks No. 40, tap $\frac{1}{4}$ -in. or 5-B.A., and fit spring-pins of $\frac{1}{4}$ -in. steel rod, as shown in the illustrations. Screw the



Coupled wheel

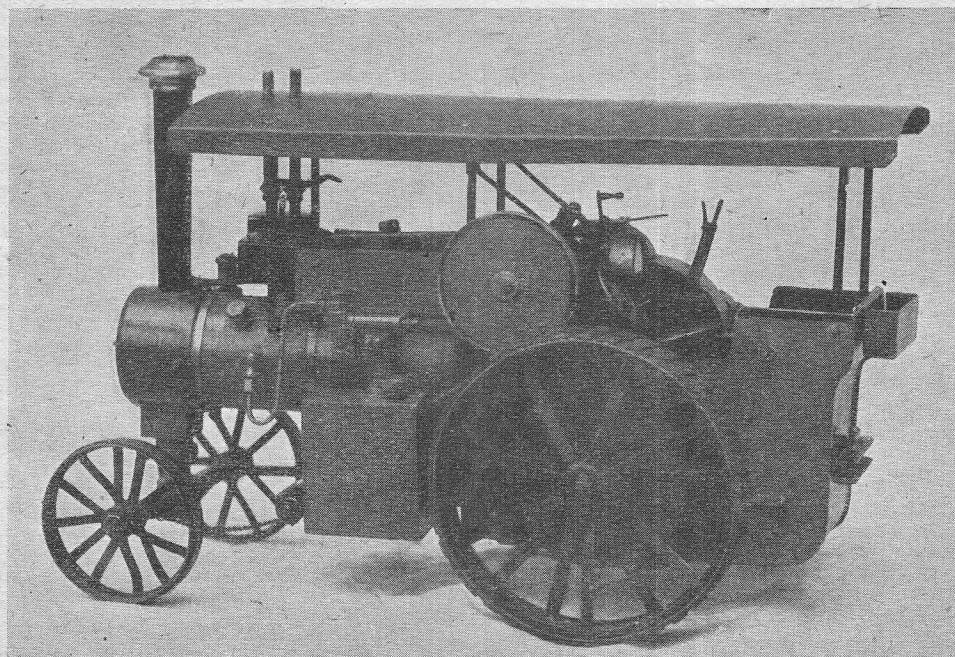
pins with a die in the tailstock holder, to ensure true threads. Drill a $\frac{1}{16}$ -in. oil-hole, and countersink it, in the top of each axlebox; then assemble the whole issue as shown. The boxes should be quite free in the horns, without having any end play; but on no account must the flanges be tight on the hornblock guides. In fact, it is advisable to ease them a little, top and bottom, with a flat file, so that the boxes are able to tilt slightly when the engine runs over an uneven

mounted on the driving-axle of the outside cylinders ; it is turned out of a piece of $1\frac{1}{2}$ -in. rod. I use stub ends of shafting for jobs like these ; it is good stuff. Chuck in three-jaw, face the end, and turn the groove $\frac{1}{16}$ in. from the end, with a parting-tool. Part off $\frac{5}{8}$ in. from the end ; parting-off is a nightmare to many amateur lathe users, but it needn't be. Grind a little lip in the end of the parting-tool, keep it at exact centre height, run at a medium speed, use plenty of cutting oil (Houghtolard or Vacmul with one-third its bulk of paraffin added) and the tool will march into the steel without chatter, the cutting coming off like a tightly-coiled watch spring, with a sound like bacon frying, and a not-so-appetising sniff. The tool marks will indicate the true centre of the piece ; at a $\frac{1}{4}$ in. away, make a centre-pop, drill it first $\frac{1}{8}$ in., then $31/64$ in., and ream $\frac{1}{2}$ in. It would be advisable to chuck the blank in the four-jaw with the pop-mark running truly, and do your drilling and reaming from the tailstock, in the usual way ; because, if the hole doesn't go through square, the eccentric will wobble in a way it wasn't intended to do, and jam the pump-ram or bend the rod. Mount the blank on a mandrel—stub of steel rod held in chuck, will do fine—and turn down the end away from the groove, until you have a boss $\frac{1}{4}$ in. wide and about $\frac{3}{8}$ in. diameter as shown. Drill and tap this for a 5-B.A. set-screw, and another little bit of the "Lassie" is completed.

What Might Have Been

With all due respect to the opinions put forward by Mr. K. N. Harris, on page 621 of the December 27th issue, I am afraid he is still very much off the mark regarding the replacement of a set of conjugated valve-gear. It is rather news to me that there are "plenty" of conjugated gears in use ; I thought the only one in general use was the Gresley gear, or the "two-to-one," as the enginemen term it ; and there is no complication about that ! It could easily be arranged as a self-contained unit, which could be removed bodily, and a replacement installed, by the usual running-shed staff without interfering with the normal running of the engine. If Mr. Harris has had any personal experience in the actual running and maintenance of locomotives—not the kind one gets in the drawing office, or on the clerical staff—he surely would not assert that the inside valve-gear of a three- or four-cylinder engine with separate gears could be taken down and replaced in the same time. Regarding efficiency, it may be remembered that the 126-m.p.h. "Mallard" has the Gresley conjugation.

Because something *might* have been, is not to say that it is inferior to what *has* been, or actually is ; if certain people had kept their sanity during the past six years, and put all their energies into construction instead of destruction, can anybody deny that what *might* have been, is vastly superior to what *is* ?



Built on the kitchen-table by Mr. R. H. Small, of Cookham Dean, this traction engine has a cylinder $\frac{1}{2}$ in. by 1 in., boiler $2\frac{1}{2}$ in. by $7\frac{1}{2}$ in., 75 lb. pressure, back wheels 7 in., leading wheels 4 in., and 2-speed gear.

A.D. 1329; and Salisbury 1386, down to the invention of the anchor recoil escapement, *circa* 1675, by Dr. Hooke, still universal in grandfather clocks; and from the "Nurenburg Egg" watches of 1600 down to about 1880, the Verge escapement held sway. Undisputed in the case of clocks, and gradually displaced in the case of watches by Graham's cylinder, 1725; Mudge's lever, 1759; Dutertre's duplex, 1780, and a host of other escapements good, bad, complicated, or simple. The chronometer escapement, as originated by Arnold, 1771, and brought almost to its present form by Earnshaw, 1783, is,

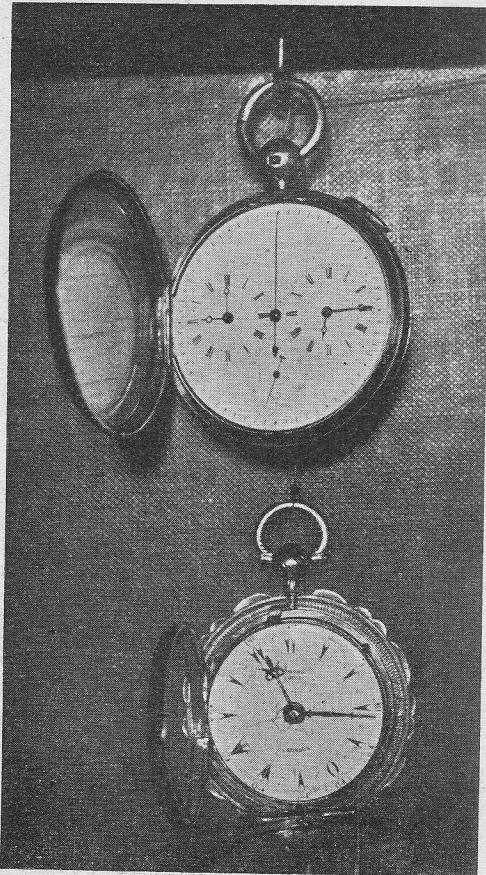


Fig. 2—(Above). Jump-seconds chronograph. (Below).—Verge hunter, Turkish numerals. Edward East, c. 1800

perhaps, the most perfect of all. But it is really quite unsuited for use in watches, though it has been employed in them from time to time.

In watches of modern times—1870 onwards—only three types of escapement are generally found; the cylinder escapement being very popular in the Victorian era for medium grade watches, and more recently for cheap watches. The lever, concurrent with these and thence on to the present day, has held undisputed

sway for all better class watches, and the pin pallet lever for cheap watches, alarm clocks and such like. As for the future, it seems unlikely that, unless some quite revolutionary escapement is invented, any watches other than lever or its cheap variation, the pin-pallet, will ever be made again in any quantities.

Before giving some particulars of those watches in the writer's collection, which are illustrated in this article, he would refer readers interested in drawings of the various escapements, to the following books, at least one of which should be available at a public library. Britten's "Watch & Clockmakers' Handbook"; Saunier's "Modern Horology" (1868); Paul Chamberlain's "It's About Time," and, of course, the two MODEL ENGINEER handbooks previously mentioned, as a base from which to start.

Fig. 1 shows (top) a Verge watch of normal design, Maker, R. Williams, Liverpool, 1818. The "Cock"—always ornate and elaborately chased in Verge watches of this period, is rather amusing, as it bears a bust in low relief of the Duke of Wellington. One is almost led to the conclusion that it was a sort of V-Day souvenir sales stunt! Originally owned by a forbear of the writer's, it was in a dreadful state. Breakage of the mainspring had resulted, as is unfortunately often the case, in breaking the fusee chain, which had then wound itself round the contrate wheel (fourth wheel) arbor, snapping off one pivot. The owner, probably at the time of the accident, had then completed the wreckage by investigating matters with his penknife, ending by tying the hair spring up in knots and smashing the verge itself (equivalent to the balance staff in modern watches). The pivot was repaired by the usual method. The contrate wheel being removed, the arbor was chucked in a collet chuck and the jagged end of the broken pivot filed flat with lathe running. The centre was then "picked up" by a sharp graver used on the hand T-rest. A pivot drill of a size slightly smaller than the original pivot, about 0.015 in., was then fixed in the tailstock runner and a hole drilled in about 0.030 in. deep. (These pivot drills are merely model editions of the old-fashioned engineers' diamond pointed flat drills. In the bigger sizes, such as the one referred to, they are quite easy to make from needles—or can be purchased in all sizes down to about 0.005 in.). The main points to observe, apart from avoiding breaking them off in the hole, which is ridiculously easy and by no means unknown in the trade, is to use a fairly slow-speed of the lathe mandrel, light but steady pressure on the drill, re-sharpening on a fine oilstone when it gets in the least blunt, and lubricate with turpentine. In modern watches it is almost essential, and in these old-timers desirable, to "let down" the damaged arbor to a blue temper before commencing the operation. If an attempt is made to carry on with a blunt drill it will cease to cut and rub up a glass-hard surface instead.

Then you are sunk, or nearly so! The only hope is to re-soften the work, re-sharpen the drill to a different point angle, and hope that with heavy pressure you will get a fresh start under the skin. More likely you will break the drill.

of the watch is most peculiar, the five "ticks" per second, as in an ordinary one, being superimposed by an extra loud one every second from this flirt gadget. A slide in the band of the case introduces an obstruction into the path of the flirt when the stop-watch part is not required.

Amongst other repairs carried out, were re-pivoting the top end of the balance staff; new mainspring and two teeth replaced in main barrel; adaption of a silver case off another watch, making and fitting thereto the sliding arrangement for stopping and starting the "jump-seconds" train. It appears that these watches were fairly popular with the masters of the big sailing ships, no doubt for setting to exact time by the ship's chronometer, and then carrying on deck for determining the ship's position.

The lower watch is a brass gilt hunter, by Edward East, of London, c.1800. Made especially for the Turkish market, it is provided with Turkish numerals, which all look very much alike to the uninitiated. The main repair to this watch consisted of replacing the motion work (the 12 to 1 compound gearing between the minute and hour hands). This had been lost, and after a fruitless search amongst the scrap to try to find a minute wheel-pinion which was of the correct number of teeth and pitch to mate with the existing surviving cannon pinion and hour wheel, recourse was had to a complete new motion work from another movement. The difficulties were, (1) the centres D, Fig. 3, were wider, and (2) the bore or hole through the cannon pinion was larger than the centre arbor, on which, of course, it had to fit light-friction tight. The sketch shows C, the centre-

wheel arbor, K, cannon pinion, the extended boss (pipe) of which is squared to carry the minute hand. M is the minute wheel, compounded with the minute pinion, which drives the hour wheel H, the pipe of which carries the hour hand. Difficulty (2) was solved by cutting off the projecting centre arbor C just proud of the dial plate, drilling it up, and pressing in a new piece of larger diameter, as described for re-pivoting, and reducing this to a good friction-turning fit in the bore of K. Difficulty (1) was then easily overcome by removing the stud on which the old minute wheel had worked, and drilling for and pressing in a new one of correct diameter to fit the hole in the new wheel M, and at the correct new centres D. The angular position of the new stud had to be altered at the same time, as the new M was larger than the old, and had to be placed in a different position to avoid fouling other parts. Finally, the shoulder between the new H and its pipe had to be faced back and adjusted to clear the back of the dial, and bring the hour hand to correct height.

Fig. 4 is a verge watch by John Halsted, or Halstead, London, *circa* 1690. Apart from the "usual" major repairs, the whole movement was rusted up solid, and had to be immersed in penetrating oil for some time before it could even be dismantled. The hairspring had entirely departed through rust, leaving a spiral rusty trade mark on the top plate. The new hands are filed and drilled from ordinary "spade" hands, and bear a moderate resemblance to the style originally employed.

(To be continued)

How to Make a Knurler

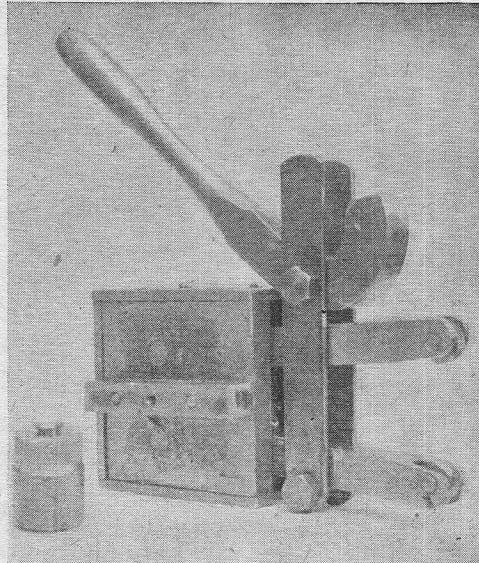
RECENTLY, I had to make several $\frac{1}{8}$ -in. knurled screws. The push-on type of knurler was useless. I got over the trouble by making the knurler shown in the photograph. By using this tool I found that I could knurl a brass rod $\frac{1}{8}$ in. diameter an inch from the chuck. Any size of rod can be knurled from $0\frac{1}{8}$ in. to $2\frac{3}{8}$ in., with the arms fitted at 6 in.; if a larger diameter is to be knurled, larger arms can be fitted. The overall cost of this tool is about 2s. 6d., plus the cost of a pair of knurl wheels. The materials required are as follow:

Mild-steel: one piece, 3 in. \times 3 in. \times $\frac{1}{2}$ in.; one piece, 3 in. \times 3 in. \times $\frac{1}{4}$ in.; two pieces, $3\frac{1}{8}$ in. \times $1\frac{1}{8}$ in. \times $\frac{1}{8}$ in.; one piece, 3 in. \times $1\frac{1}{8}$ in.

\times $\frac{1}{8}$ in., to form open-end box. Two pieces 6 in. \times $\frac{3}{8}$ in. \times $\frac{5}{8}$ in., arms; two pieces, 5 in. \times $\frac{3}{4}$ in. \times $\frac{1}{8}$ in., link; one piece, 9 in. \times $\frac{3}{4}$ in. \times $\frac{3}{4}$ in. lever.

My tool-holder is the four-way type and is held in position by a piece of $\frac{1}{2}$ in. \times $\frac{1}{2}$ in. \times 3 in., screwed on to the box. When in this position, the knurl wheels are centred over and under the rod to be knurled and the lathe put into slow speed, the lever pushed over to bring the wheels together with the rod to be knurled between. It will be seen that the work and wheels are kept dead centre without any difficulty.

A. L. PALING.



to carry on with these supplies, or whether they have lost interest in them. This state of affairs is not very satisfactory, either to prospective customers or to me, as I am often bombarded with questions which I cannot answer satisfactorily. But there are, I am happy to say, many dealers in model engineering supplies who are fully alive to the pressing needs of the time, and are making great efforts, not only to ensure an output commensurate with rapidly growing requirements, but also to improve quality of the products to conform with modern standards.

Progress in the design of model petrol engines is bound to involve a certain intricacy in the form of the castings used in their construction, and I have often been disappointed with the castings of engines which have been marketed in the past. There are great difficulties in producing really accurate and clean castings by the usual foundry processes, though much can be done to improve matters if the moulders are really interested in this class of work; but for infallible accuracy and consistent high quality, die-castings are the only practicable answer to the problem. On account of high initial costs, however, most dealers in model engineering supplies have been very slow in taking advantage of the possibilities offered by die-casting. It is rather significant, that in this, as in many other progressive developments in model engineering, it has been left to the amateur to lead the way. Successful die-castings of model petrol engines described in *THE MODEL ENGINEER* have been produced by several readers, not to meet the needs of mass production, but simply with the object of producing a better quality product than is possible by sand casting. The "Atom V" design appears to be a favourite, for some reason or other, for the exercise of the amateur die-sinker; some excellent die-castings for this engine have been produced by Mr. L. Powell, of Cheadle, also Mr. J. Willis, of Dublin; and on a recent visit to the Birmingham S.M.E., an anonymous member, in a very apologetic way, produced from his pocket some samples of "Atom V" components which he had cast in his own home-made dies. I should, however, point out that there is, as yet, no indication that these castings are available in the open market, though I have hopes that something will be done about it before long.

Some weeks ago I was informed by a Bristol reader that he was producing dies for the castings of the "Kittiwake" 15-c.c. four-stroke engine, and my advice was asked as to the possibilities of marketing these castings. Examination of samples has convinced me that their general quality is at least equal to that of the very best sand castings of this engine which I have yet seen, and in accuracy, and reproduction of fine detail, they are considerably above the average standard. This is particularly evident in the case of the cylinder-head, in which the deep finning presents abnormal problems for sand moulding, and it has been the exception rather than the rule, to obtain perfectly clean castings, free from blemishes caused either by the collapse of thin sections of the mould, or inability of the molten metal to reach the odd

corners. Such troubles can be positively eliminated by the use of well-designed dies, and, moreover, the chilling effect of the die helps to ensure against the very prevalent faults, such as blow holes or lack of homogeneity in castings.

The parts so far produced by die-casting for this engine include the two halves of the crank-case, the cylinder-head, piston and rocker-box; other components are coming along steadily. It may be of interest to record that in casting the internal shape of the piston, which includes the gudgeon-pin bosses, it is necessary to use a collapsible metal core; the method employed for die-casting pistons has, however, been described in *THE MODEL ENGINEER* on more than one occasion, and with certain variations, holds good for all types of I.C. engine pistons.

At the time of writing, arrangements for the marketing of these castings are not fully completed, but I understand that they will be announced in the advertisement columns of *THE MODEL ENGINEER* as soon as ready. I am, therefore, withholding the name of the producer for the present, but shall be very pleased to pass on any enquiries from readers who may wish to obtain castings for the components so far produced.

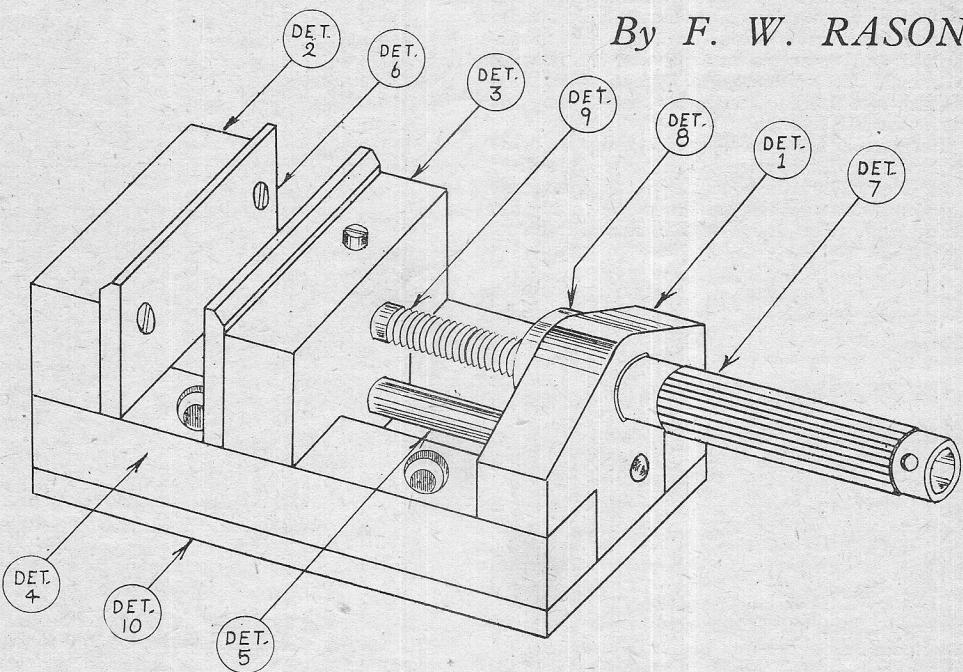
A New British Model Aircraft Engine

Many queries have been received from readers who wish to produce ready-made engines, but I have been unable to help querists in this respect, as such engines have been absolutely unobtainable all through the war. I have, on a few occasions, been accused of an antagonistic attitude to the commercially-produced engine, but this is only true in a purely negative sense. As I have, for many years, been trying to assist readers to build, and even to design, engines for themselves, this policy is bound to come foremost with me, but I realise that many readers who have no facilities for the construction of engines may obtain a great deal of pleasure from the handling of a commercially-made engine, and that many non-technical users of engines in model planes, boats, and cars may often become converted to real model petrol engine enthusiasts.

It has, however, been a matter of great regret to me that the development of the small petrol engine, as a finished product, has been sadly neglected in this country, especially in view of the fact that much of the pioneer work in the design and application of such engines can be credited to British model engineers. The lack of any really good British engines, in pre-war days, which many prospective buyers have deplored, has not been due to the inability to design, or yet to manufacture, such engines, but to the failure of the trade to envisage the commercial possibilities in them. There were several half-hearted attempts to manufacture engines, but in no case, so far as I know, was anyone prepared to undertake production in large enough quantities to be economically practicable. My own unfortunate experiences with the original "Atom Minor" and other engines has taught me how effectively a good

Construction of a Machine Vice

By F. W. RASON



A MACHINE vice, it will be agreed, is a most useful addition to the workshop, in fact, once having become accustomed to having it "around," many will say it is indispensable; providing it is of good weight and has a reasonable capacity for work, it simplifies many otherwise difficult jobs.

The one so described has a maximum range of $2\frac{1}{4}$ in., and a jaw depth of $1\frac{3}{16}$ in., its weight is in the region of 4 lb., and, therefore, heavy enough to steady quite large drilling operations, while the vice handle is of the type which readily affords a good hold at all times, and does not "disappear" when work of small dimensions is being clamped up.

From an "ideal" point of view, a vice should be machined from the solid, but for many, who have not the necessary machines (a miller or shaper) at their disposal, it is out of the question to consider it.

However, the "built-up" vice can be made quite satisfactorily, providing the workmanship is good, and a little hard work in the initial stages is not objected to.

Details 1, 2, and 3, being of similar section, and comprising the most important parts of the vice, were made first, and providing they are produced with the necessary accuracy, a good finished job is almost assured.

Apart from detail 1, which, for convenience of drilling, should be radiused after this is

carried out; shaping and drilling can be done in a straightforward manner, the fullest advantage being taken of hole transference where accurate alignment is essential.

When cutting to size, it is, of course, advisable to work as near the marking lines as possible, it being appreciated that the least amount of filing on steel of this thickness the better, after which the desired finish can be obtained by using an emery lap, making sure that the lap wheel is square with the table.

The tie-bars, detail 4, made from square mild-steel bar, need little comment, and when these, along with details, the "keeper" rod, are finished, the pieces can be assembled to see how things are lining up, proceed to "fit" the moving jaw bolster until it rides nice and free, but avoid any excessive play.

It should be noted that detail 3 rides on, and is intended to be guided by, the tie-bars, the sole function of detail 5 being to prevent the moving jaw from tilting when tightening up, should it be riding or binding on this rod, a $\frac{3}{8}$ -in. expanding reamer should put matters right.

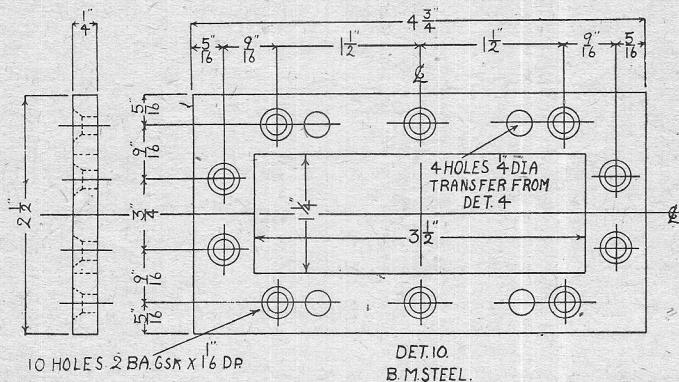
Detachable jaws, detail 6, are made from "gauge" steel, and may be hardened if desired; these are easily replaced if damaged, or quickly substituted for those containing vee-slots or other contours for holding special jobs.

Detail 7, the handle, must be carefully machined, the bearing surfaces to be a good

running fit in detail 1; watch especially the bore for the thread, it is essential that this be concentric; otherwise, when engaged with the screw, binding will result.

The handle can be either straight or diamond knurled, perhaps the latter is more advisable,

There remains now the base-plate, detail 10, which, after shaping and drilling, is clamped on to the underside of the vice and the fixing holes transferred; after which screw up solid, and then, in turn, transfer from detail 4 the four fixing holes which are provided for securing



as straight knurling tends to twist on long runs, and looks bad; see that the resulting diameter does not approach that of the bearing in detail 1, as the handle must pass through it on assembly.

The function of detail 8, the retaining ring, will be obvious; a little core is required here to prevent fouling the handle locator; the same can be said for the latter's outside diameter, which must be free in the housing.

A good push-fit should be aimed at when fitting detail 9, the screw-rod, to detail 3, and when satisfied that everything is in alignment and running smoothly, secure by drilling and tapping for a 4-B.A. steel screw, as shown in the drawing.

the vice to a machine or bench, should it so be required.

Some readers may be in favour of dowelling at various positions, but in view of the work likely to be encountered in my own particular workshop, it was not considered vital, and having given a good account of itself over a period of years, has shown no weakness in this respect; all screws must be of steel, and well screwed up.

All the dimensions given in the drawings are nominal, but a little consideration in conjunction with these notes should soon decide when to "give a thou." and when to "take a thou." and so reducing to a minimum the amount of fitting on the final assembly.

Jars for Nuts and Bolts

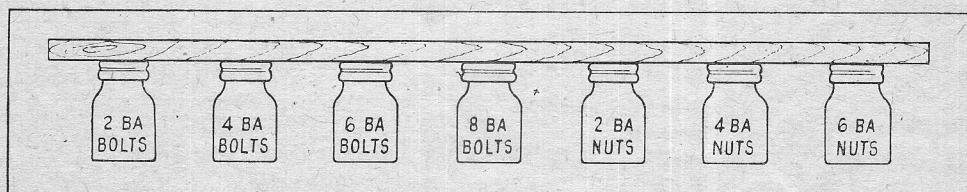
ONE of the most convenient methods of keeping small bolts, nuts, washers, etc., is in small screw-top glass jars, such as are used for hand and face creams, and other commodities.

The screw cap is attached to the underside of a shelf by means of two brads; one is not sufficient, as the cap is liable to turn when

the container is screwed up or unscrewed.

There is really no need to affix labels, as the contents are, of course, visible. Apart from the direct convenience of being able to find the right bolt or nut instantly, one is able to "take stock" all the time, and so there should be no excuse for running out.

"SMALL BORE."



A Home-Made Microscope

By J. B. Sheen

I STARTED the construction of this microscope in June, 1943, not altogether an ideal time, owing to shortage of material and so forth. However, as most readers will agree, once the mind of a model engineer is made up, it takes more than a bomb or two to shift it.

Now, I would like to make it quite clear, that throughout the whole construction, pencil never touched paper. No sketches were made of any part ; the design is entirely my own and follows no commercial pattern, other than what I could remember from my very longing gazes into shop windows. Apart from the fact that I much prefer to make things without drawings, most readers, I know, will agree with me when I say that we who worked for the whole of the war in a toolroom, have seen enough lines and dimensions to last us for quite a while, so hence the lack of enthusiasm in the drawing office.

The base was constructed first, and presented little difficulty, merely plain turning, the main limbs being sawn and filed up and afterwards sweated into slots cut in the circular portion. The two pillars are secured by two screws up from the bottom, but before being fixed a piece of $\frac{1}{8}$ -in. thick ebonite was turned to fit the base, and although not visible in the photograph, carries a brass disc with my initials filed right through, and then filled up with black wax, the finished effect of the lacquered brass and polished ebonite being quite pleasing. In passing, I might add that I always have had a "kink" for lacquered brass, much preferring it to the more modern chromium plate and black crackle finish.

The next part to be taken in hand was the main limb. This is hollow, being sweated up from brass sheet. I might add the sweating was carried out on the domestic electric cooker. Those of our readers who possess one will find this a "tip" worth bearing in mind ; the hot plates are ideal for soldering and the flat surface comes very handy at times.

On the front part of the limb is fixed the female slide for the fine adjustment, more about these slides being mentioned later.

And so to the main barrel ; this consists of drawn brass tube, which at one time served purpose as a garden syringe, two brass rings were sweated in each end and screw-cut to receive draw-tube assembly and nosepiece. The main slides for the coarse adjustment are screwed on to the back. These slides, which are dove-tailed and adjustable for wear, did present a slight difficulty. We always hear a lot about clamping them to a cross-slide with a cutter in the chuck—this is an excellent idea for short lengths, but to mill a slide some 4 in. long on the cross-slide of a normal 3-in. lathe, is, to say the least, expecting a lot, so not possessing a milling machine some form of shaper was indicated. A look in the junk department produced three old lathe slides ; the two largest with the aid

of a "few hefty blocks of wood" were mounted at right-angles one above the other, the small one being fixed in front of the top one ; a strip of steel was fixed to form a con. rod from the top slide to a radial point on a large wheel, which was, in turn, driven by an old car dynamo connected up as a crude shunt wound motor and driven by a generator, hence a motor driven "shaper," which, in actual time, took ten hours to make. This "Heath Robinson" contraption enabled me to make an excellent job of the slides and came in useful for many more jobs before the completion. The slides were finished by lapping them together. The coarse adjustment was then fitted ; this is a helical cut rack and pinion—the only mechanical part being purchased out. This was made by Broadhurst Clarkson, whom I have always found most useful and helpful in all optical matters.

The next part to receive attention was the stage—the most tricky part of the whole job. It is fully compound, forward and backward movement, sideways and revolving ; there are some fifty 10 B.A. screws in its construction. All the slides are square and were filed up from plate. The stage proper is a circular table of brass ; incidentally, this was turned from the base of an old German shell case consigned to the scrap box years ago. The centre of the table is recessed out and contains an ebonite disc to carry the usual clips ; the outer edge of the brass part is bevelled off and is divided up into 360 degrees—this rather tedious job being carried out on the lathe. The complete assembly works quite smoothly and stands up to its errors being magnified two thousand five hundred times when the 1/12-in. oil immersion objective is in use.

After completing the stage, the remainder was comparatively easy. The sub-stage condenser is rack and pinion holding a brass ring with three centring screws to take an Abbe condenser, both rack and pinion being cut on the lathe. Below this is the mirror, completely universal in its movement, and fitted with plain and concave mirrors.

The draw tube was made next, again fitted with rack and pinion, and carries standard-size eye-pieces.

The nosepiece was made last, and consists of two cones of brass, the top one being screwed into the base of the main barrel and the bottom revolves with an index finger locating the three screwed bushes, which take standard objectives. This proved quite an interesting exercise in turning ; both inside faces fitting perfectly, as the top slide of the lathe was not moved, the male being turned in the normal manner and the female turned with the boring tool turned upside down, a sure method of getting both faces exact.

The last operation was mainly polishing and lacquering ; most of the circular polishing was

To sum up, I think that more of these instruments should be made by model engineers. As well as being useful, they provide plenty of scope for the skill of an engineer, and also make a nice ornament for a study or other such room. By the by, if any reader should make one, let him be advised by me to hunt out the second-hand shops for an old glass globe that once served purpose to cover waxed fruit, and keep the microscope under this, as the feminine section of the house, as a rule, always refrains from dusting this sort

of thing, in case they should damage something.

I sincerely hope this article has been of interest, and before closing, I would like to thank my mother, who was responsible for obtaining most of the scrap brass, many times visiting junk yards when I was unable to get there at their open times; also my friend, who used his excellent knowledge of photography in producing a very fine photograph; and last, but not least, my wife, who, after much effort, persuaded me to write this article.

Letters

Further Car-Racing Notes from Stoke

DEAR SIR,—Some weeks ago I wrote a short account of miniature racing-car activity in Stoke-on-Trent, and I think that, perhaps, in view of recent further progress, a few more words on the subject may not be without interest.

In the article, I mentioned that my miniature car had attained an average of 67 m.p.h., for a quarter-mile, but that the centrifugal force, owing to the conditions under which the car was running, became equal to over 20-times the force of gravity and was causing fuel-feed trouble; and sundry others also arose.

Since then, a considerable number of alterations have been made to the car, amongst which may be mentioned the fitting of a "chicken feed" type of fuel-tank, the designing and making of new wheels which will stand revolving at some 20,000 r.p.m. without any signs of trouble, (*i.e.*, no tyre lifting), the fitting of new miniature accumulators in a horizontal position, and the moving of a little more of the car's weight of 5 lb. over the driving-axle.

The net result of these alterations has been, without exception, entirely satisfactory; for, on two runs made by the car on December 26th, averages of 70 m.p.h. and 71.4 m.p.h. for the quarter-mile were recorded, and no trouble whatever was experienced. This makes me wonder if it is merely the "lull before a storm"! As my electrical timing apparatus has not yet been altered, as it will be, to time and count any number of laps up to sixty, which, on our track, constitutes a mile, no timing was attempted for this distance, as I consider hand timing, except, perhaps, by experts, to be somewhat erratic at these speeds.

On each of the two runs, however, the car was allowed to travel well over a mile, and was actually travelling a shade *faster* at the *end* of the mile, and this was when the 71.4 m.p.h. figure was reached.

The next job, obviously, is to make the timing-gear capable of recording the time taken over a mile; and this will be done at the first opportunity, after which I hope to be able to give information of the car's average speeds over the half and one mile.

Yours faithfully,

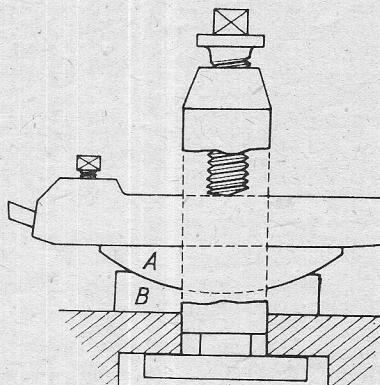
Stoke-on-Trent.

F. G. BUCK.

Workshop Ideas

DEAR SIR,—*Re* J.K.M.'s article on a "Tool Post for Small Lathe," page 475, Vol. 93, has not this gentleman rather missed the whole point of the American tool-post, by failing to describe the lovely curved packing-piece and the radiused collar, which obviates the usual bits of packing, broken hacksaw blade, old tin, etc., which most people use after resetting a bit in the tool-holder as described?

I give a rough sketch of what I mean, with the parts in question marked *A* and *B*, and if any of your readers decide to make up one of these fittings, I am sure the time spent on providing these essential parts will be well repaid.



Furthermore, I wonder how many amateurs ever think of incorporating a reversing switch with their repulsion-start motors. This is most useful when parting off, or dieing threads with a tailstock die-holder. In fact, I am now getting so old and lazy that I always use it when changing chucks, etc.

The wiring is easy, and I should be very pleased to help anyone interested.

These ideas may have been dealt with in your earlier issues, so I won't waste time talking about the benefits of using parting-tools upside down, etc.

Yours faithfully,

Yours faithfully,
HENRY L. PARSONS.

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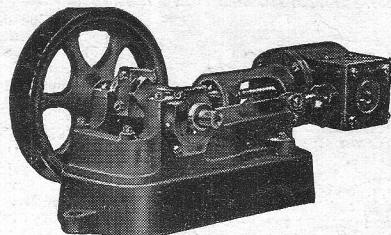
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